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PULP&PAPER

'84 '85 NORTH AMERICAN FACT BOOK

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Information in this volume is designed to present a comprehensive review of the structure and status of the pulp and paper/board industry of United States and Canada. Every effort has been made to provide accurate data. To the best of the editors' knowledge, data are reliable and complete, but no warranty for this is made.

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NORTH AMERICAN OVERVIEW

North America is the world's most important pulp and paper producing region, accounting for about 50% of worldwide pulpmaking capacity and 40% of paper and paperboard capacity.

Paper and paperboard production should just about match general economic activity during the decade of the 1980s. Domestic demand may grow slightly less than real gross national product because of growing competition from new forms of electronic communication in paper markets and from inroads by plastics in the packaging area. However, exports of paper and paperboard should show faster growth than domestic demand because of North America's position as a low-cost producing region in the world.

The North American Overview is divided into two sections: United States, and Canada. For each country there is a chapter that examines trends in production, exports/imports, prices, profitability, capital spending, capacity expansion, mergers and acquisitions, employment, wood supply, environmental control and regulations, energy and chemical use, and transportation costs.

FINANCIAL DATA

All sales and earnings figures are shown in U.S. dollars, unless indicated "C$" for Canadian dollars.

PRODUCTION DATA

All capacity production data are in short tons of 2000 lb, unless specifically indicated as metric.

To convert to metric tons:
multiply by 0.90718

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UNITED STATES

INDUSTRY STRUCTURE

The U.S. paper and allied products industry ranks ninth among manufacturing industries in shipments, falling behind food, transportation equipment, machinery, petroleum, chemicals, primary metals, electrical equipment and fabricated metals in size. The industry's shipments of $85.14 billion in 1983 accounted for 4.2% of total U.S. manufacturing shipments, while its workforce of 661,000 employees amounted to 0.9% of the total U.S. nonagricultural payroll. Employment has declined during recent years, falling from 667,000 in 1981 to 662,000 in 1982, Commerce Dept. data show.

In terms of sales, the largest U.S. paper/forest products company in 1983 was Georgia-Pacific Corp., with revenues of $6.47 billion. Weyerhaeuser Co., which like G-P does a substantial amount of business in forest products such as lumber and plywood, was second with sales of $4.88 billion, followed by International Paper Co. at $4.36 billion in 1983 sales. Fourth-largest in 1983, Champion International Corp. will become by far the largest U.S. paper company after its merger with seventh-place St. Regis Corp., which was due for completion by the end of 1984.

Industry leaders. Even with the sale of its Canadian operations in 1981, International Paper remained the industry capacity leader by a wide margin, with 16,070 tpd of pulp and 13,940 tpd of paper and paperboard—27.9% of total U.S. woodpulp capacity and 18.9% of paper and paperboard capacity. Weyerhaeuser was second in pulp capacity with 11,005 tpd and also second in paper and board, with 9,585 tpd of capacity. Champion International was third in paper and board, with 8,330 tpd of capacity, while Georgia-Pacific was third in pulp capacity, with 9,862 tpd. Champion will take over International Paper's long-standing first place position in paper and board after merging with St. Regis, even allowing for the sale of St. Regis's Kraft Div. mill in Tacoma, Wash., which the Federal Trade Commission has ruled Champion must hold separate from other St. Regis assets. IP will still edge out Champion in pulp capacity, however.

Newcomers among the top 15 producers include James River Corp., Stone Container Corp. and Temple-Inland Inc. James River went from 27th place in paper and board capacity in 1981 to 14th in 1983, while Stone Container jumped from off the list to tenth place, both on the strength of major acquisitions. Temple-Inland, 15th in paper and board capacity, is a new company

MACHINES IN OPERATION IN THE U.S. PAPER INDUSTRY—BY GRADE IN 1975 AND 1982

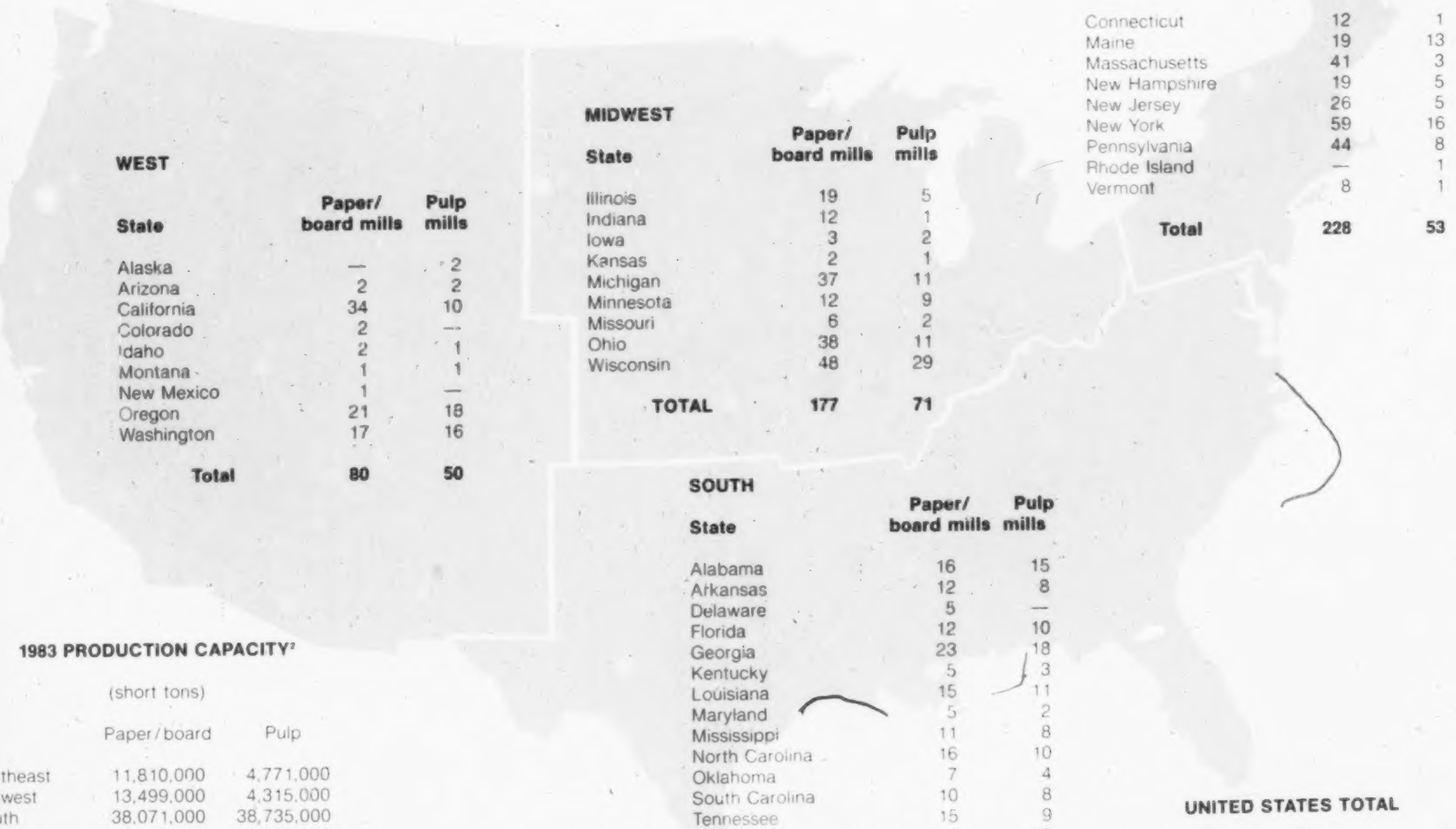
	Number of machines		Machine capacity
	1982	1975	1982
All grades	**1,352**	**1,578**	**73,118**
Total paper	**910**	**981**	**34,665**
Newsprint	44	38	5,654
Uncoated groundwood	34	38	1,655
Coated papers	84	81	5,516
Uncoated free sheet[1]	264	278	9,200
Thin papers	44	62	369
Solid bleached bristols	15	16	1,069
Pkg. & ind. conv.	194	228	6,076
Tissue	231	240	5,125
Total paperboard	**340**	**395**	**35,421**
Unbleached kraft	72	69	17,402
Solid bleached	30	31	4,123
Semichemical	44	51	5,207
Recycled	194	244	8,690
Total other paper & board	**182**	**202[2]**	**3,032**

1. Includes cotton fiber.
2. Includes hardpressed board in 1975 only.

Source: American Paper Institute.

NUMBER OF PULP, PAPER AND BOARD MILLS IN UNITED STATES, BY REGION

(Number of millsites)[1]



WEST

State	Paper/ board mills	Pulp mills
Alaska	—	2
Arizona	2	2
California	34	10
Colorado	2	—
Idaho	2	1
Montana	1	1
New Mexico	1	—
Oregon	21	18
Washington	17	16
Total	**80**	**50**

MIDWEST

State	Paper/ board mills	Pulp mills
Illinois	19	5
Indiana	12	1
Iowa	3	2
Kansas	2	1
Michigan	37	11
Minnesota	12	9
Missouri	6	2
Ohio	38	11
Wisconsin	48	29
TOTAL	**177**	**71**

NORTHEAST

State	Paper/ board mills	Pulp mills
Connecticut	12	1
Maine	19	13
Massachusetts	41	3
New Hampshire	19	5
New Jersey	26	5
New York	59	16
Pennsylvania	44	8
Rhode Island	—	1
Vermont	8	1
Total	**228**	**53**

SOUTH

State	Paper/ board mills	Pulp mills
Alabama	16	15
Arkansas	12	8
Delaware	5	—
Florida	12	10
Georgia	23	18
Kentucky	5	3
Louisiana	15	11
Maryland	5	2
Mississippi	11	8
North Carolina	16	10
Oklahoma	7	4
South Carolina	10	8
Tennessee	15	9
Texas	16	10
Virginia	15	11
West Virginia	2	—
Total	**185**	**127**

1983 PRODUCTION CAPACITY[2]

(short tons)

	Paper/board	Pulp
Northeast	11,810,000	4,771,000
Midwest	13,499,000	4,315,000
South	38,071,000	38,735,000
West	10,637,000	9,768,000
TOTAL	**74,017,000**	**57,590,000**

UNITED STATES TOTAL

Paper/board mills	**668**[3]
Pulp mills	**302**[3]

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[1] Integrated mills producing pulp and paper are counted twice, once as a pulp mill and once as a paper mill. Pulp mills producing two or more different types of pulp are counted only once.

[2] Based on Capacity Survey 1984, American Paper Institute

[3] Includes one mill in Puerto Rico

spun off in 1983 from Time Inc. Companies bumped off the list were Continental Forest Industries—the source of Stone Container's capacity acquisition—Container Corp. of America, and Hammermill Paper Co.

About 44% of the industry's 1981 sales came from primary production of pulp, paper, and building board, with the remainder from converted products. Paper accounts for 57% of the primary sector's shipment value, while paperboard accounts for 31%, market pulp 10%, and building paper and board 1.6%. The converting side of the industry is fairly evenly divided between paper and paperboard converting, with cor-

LEADING U.S. FIRMS

(1983 sales of companies with capacity of 1,000 tpd or higher)

Rank	**Company**	**1983 sales**	**Pulp capacity**		**Paper/board capacity**	
			(rank)	**(tpd)**	**(rank)**	**(tpd)**
	$1,000,000,000 or higher					
1	Georgia-Pacific Corp.	$6,469,000,000	3	9,862	6	7,863
2	Weyerhaeuser Co.	4,882,629,000	2	11,005	2	9,585
3	International Paper Co.	4,357,100,000	1	16,070	1	13,940
4	Champion International	4,263,999,000	7	7,356	3	8,330
5	Boise Cascade Corp.	3,450,890,000	4	8,105	5	7,885
6	Kimberly-Clark Corp.	3,274,300,000	16	4,293	17	4,265
7	St. Regis Corp.	2,774,578,000	5	8,018	7	7,819
8	Crown Zellerbach	2,708,600,000	11	5,312	12	5,960
9	Scott Paper Co.	2,465,088,000	13	5,045	11	5,986
10	Mead Corp.	2,366,600,000	12	5,055	4	8,034
11	James River Corp.	2,301,076,000	17	3,655	14	5,125
12	Container Corp. of Amer.	1,779,000,000	20	3,100	16	4,880
13	Union Camp Corp.	1,688,254,000	6	7,750	8	7,550
14	Hammermill Paper Co.	1,622,695,000	27	2,203	27	2,209
15	Great Northern Nekoosa	1,565,000,000	8	6,720	9	6,665
16	Westvaco Corp.	1,493,412,000	9	5,823	13	5,659
17	Louisiana-Pacific Corp.	1,101,980,000	30	1,985	52	800
18	Willamette Industries	1,045,669,000	24	2,500	20	3,120
	$500,000,000-$1,000,000,000					
19	Potlatch Corp.	906,745,000	25	2,255	22	2,855
20	Temple-Inland Inc.	850,000,000	15	4,325	15	4,925
21	Fort Howard Paper Co.	785,976,000	34	1,550	35	1,650
22	Bowater Inc.	771,743,000	14	4,985	19	3,555
23	Owens-Illinois Inc.*	721,400,000	18	3,575	18	3,690
24	Sonoco Products Co.	668,628,000	55	300	24	2,412
25	Stone Container Corp.	655,847,000	10	5,500	10	6,660
26	Packaging Corp. of Amer.	651,000,000	26	2,210	21	3,000
27	Southwest Forest Ind.	636,415,000	22	2,880	29	2,028
28	ITT Rayonier Inc.	620,000,000	23	2,565	57	224
29	Jefferson Smurfit Corp.	599,884,000	47	725	26	2,270
30	Consolidated Papers Inc.	573,346,482	42	1,141	30	1,969
31	Federal Paper Board Co.	568,999,000	29	2,000	31	1,890
32	Continental Forest Ind.	517,000,000	39	1,200	47	1,075
	Below $5,000,000					
33	Appleton Papers Inc.	465,325,000	48	670	48	1,000
34	Manville Forest Pds.	426,900,000	33	1,670	28	2,040
35	Longview Fibre Co.	373,391,000	21	3,000	25	2,350
36	Publishers Paper Co.	356,100,000	28	2,135	36	1,650
37	Pentair Inc.	319,289,000	54	420	33	1,700
38	Allied Paper Inc.	315,900,000	49	600	56	525
39	Chesapeake Corp.	273,800,000	37	1,300	45	1,150
40	P.H. Glatfelter Co.	257,091,000	45	800	50	900
41	Garden State Paper Co.	151,573,000	36	1,339	41	1,281

Continued on next page

LEADING U.S. FIRMS, continued

(1983 sales of companies with capacity of 1,000 tpd or higher)

Rank	Company	1983 sales	Pulp capacity (rank)	Pulp capacity (tpd)	Paper/board capacity (rank)	Paper/board capacity (tpd)
	Data not available					
	Bato Co. Inc.	n.a.	38	1,250	44	1,170
	Caraustar Industries	n.a.	—	—	34	1,675
	Celotex Corp.	n.a.	46	740	46	1,125
	Gilman Paper Co.	n.a.	40	1,200	42	1,200
	Green Bay Packaging Inc.	n.a.	43	1,020	39	1,425
	Gulf States Paper Corp.	n.a.	50	590	55	575
	Interstate Resources Inc.	n.a.	51	525	53	700
	Jacksonville Kraft Paper	n.a.	35	1,400	40	1,300
	National Gypsum	n.a.	56	225	38	1,515
	Newark Group Inc.	n.a.	—	—	37	1,535
	Parsons & Whittemore	n.a.	31	1,727	—	—
	Procter & Gamble Co.	n.a.	19	3,395	23	2,570
	St. Joe Paper Co.	n.a.	32	1,700	43	1,200
	Simpson Paper Co.	n.a.	44	840	49	995
	Stora Kopparberg N.A.	n.a.	41	1,180	51	900
	U.S. Gypsum Co.	n.a.	53	430	32	1,855
	Virginia Fibre Corp.	n.a.	52	510	54	610

* Sales of forest products group only, not corporate total.

Source: Compiled from data in Company Profiles section.

rugated containers, sanitary tissue, bags, and paper coating and glazing ranking highest in shipment value.

Trend to concentration. Although still fairly fragmented, the long-term trend in the North American paper industry has been toward increased concentration. In the U.S., the top 15 pulp producers accounted for 56.5% of total capacity in 1983, down slightly from a 56.8% share in 1981. Over the same period, top U.S. paper and paperboard producers increased their share from 52.2% to 52.9%.

Concentration in the paper industry is particularly evident in certain individual market segments. For example, ten producers account for almost 91% of coated free-sheet capacity in the U.S. Similarly, ten companies have about 88% of total U.S. tissue capacity, and the top five have 68%, but Fort Howard Paper Co. alone is estimated to have more than 30% of the commercial/industrial segment of the market.

Economies of scale. The reasons behind the gradual growth in concentration include the growing size of mills and machines, which limit the ability of smaller companies to compete, and also rising energy, fiber and environmental compliance costs, which particularly hurt smaller, nonintegrated producers. These have resulted in increased merger activity in the industry and in continuing shutdown of older facilities, especially since the past recession.

According to American Paper Institute data, the number of mills making paper and board declined from 687 in 1976 to 581 in 1982, even though annual capacity rose from 68.2 million tpy to 73.1 million over the same period. Capacity at mills under 50,000 tpy declined by 27.5% over the period, while capacity at mills over 300,000 tpy rose 30.2%. Similarly, the number of woodpulp mills declined from 271 in 1976 to 228 in 1982, while capacity rose from 53.0 million tpy to 57.6 million. Pulp mills below 50,000 tpy lost 45.0% in capacity between 1976 and 1982, while large mills above 300,000 tpy gained 18.1%.

While total paper and board capacity rose 7.2% between 1976 and 1982, nonintegrated paper and board capacity declined 7.1% from 17.7 million to 16.4 million tons. Nonintegrated mills accounted for 22.5% of total industry capacity in 1982 compared with 26.0% in 1976, the API data show.

Size distribution. The number of paper and board machines in the industry dropped from 1,578 in 1975 to 1,352 in 1982, API statistics show. The largest number of the 226 machines shut down were recycled paperboard units, followed by packaging and industrial converting papers, thin papers and uncoated free sheet.

API data on the size distribution of machines in various grades show that many small machines still exist in the uncoated free-sheet, packaging and industrial, tissue, and recycled paperboard segments of the industry. Of the 264 uncoated free-sheet machines in the industry in 1982, 209 had capacity below 50,000 tpy, while new machines currently being installed in the industry are typically between 150,000 and 200,000 tpy in size. Of 231 tissue machines in the industry, 124 were below 20,000 tpy of capacity, while new tissue machines are generally between 50,000 and 80,000 tpy. Although many of these small machines profitably serve special market niches, some will be vulnerable to efficient new machines being installed in the higher volume, commodity segments of these markets.

U.S. MILL SIZE DISTRIBUTION FOR PAPER/BOARD AND WOODPULP

Mill capacity range (000 tpy)	Paper & paperboard				Woodpulp			
	Number of mills		Annual capacity (000 tpy)		Number of mills		Annual capacity (000 tpy)	
	1982	1976*	1982	1976*	1982	1976*	1982	1976*
TOTAL	**581**	**687**	**73,118**	**68,184**	**228**	**271**	**57,638**	**53,047**
0- 25	169	238	2,096	3,043	21	32	309	487
26- 50	99	133	3,656	4,891	20	40	778	1,491
51- 75	69	72	4,211	4,500	15	26,	983	1,620
76-100	41	52	3,716	4,606	15	20	1,220	1,779
101-125	31	32	3,582	3,565	14	15	1,605	1,688
126-150	22	18	3,003	2,506	9	13	1,232	1,724
151-175	14	23	2,301	3,714	10	13	1,612	2,094
176-200	24	17	4,531	3,194	15	9	2,843	1,682
201-250	17	20	3,775	4,440	13	20	2,799	4,330
251-300	16	17	4,325	4,608	20	12	5,414	3,270
301-350	15	19	4,890	6,081	8	13	2,563	4,212
351-400	17	11	6,469	4,171	15	13	5,638	4,971
401-450	8	11	3,371	4,617	10	15	4,290	6,397
451-500	14	6	6,600	2,888	12	8	5,681	3,858
Over 500	25	18	16,592	11,360	31	22	20,671	13,444

* 1976 includes mills and capacity for hardpressed board and supporting pulp facilities.

Source: American Paper Institute.

U.S. PAPER INDUSTRY VALUE OF SHIPMENTS RANKED WITH OTHER MANUFACTURING INDUSTRIES

($ million)

	1983	1982	% change
Nondurable goods industries	$1,025,886	$988,004	3.8%
Food, kindred products	286,605	277,324	3.3
Petroleum & coal	191,551	206,430	−7.2
Chemical & allied products	190,230	172,803	10.1
Paper & allied products	85,135	78,989	7.8
Rubber & plastics	50,320	50,163	0.3
Textile mill products	52,219	47,217	10.6
Tobacco	15,462	14,455	7.0
Durable goods industries	1,021,514	922,313	10.9
Transportation equip.	240,096	195,054	23.1
Machinery (except electrical)	178,267	180,612	− 1.3
Primary metals	117,904	107,031	10.2
Electrical machinery	156,016	141,056	10.3
Fabricated metals	120,570	113,975	5.8
Instruments & related	50,016	48,873	2.3
Stone, clay, glass	49,058	44,005	11.5

Source: U.S. Dept. of Commerce.

U.S. CAPACITY IN INTEGRATED AND NONINTEGRATED MILLS

(000 short tons)

Grades	Annual paper & board capacity					
	Integrated to woodpulp		Nonintegrated		Total	
	1982	1976	1982	1976	1982	1976
Total all grades	**56,671**	**50,482**	**16,447**	**17,702**	**73,118**	**68,184**
Paper	**27,526**	**21,360**	**7,139**	**7,851**	**34,665**	**29,210**
Newsprint	5,212	3,589	442	425	5,654	4,014
Uncoated groundwood	1,515	1,093	140	216	1,655	1,309
Coated groundwood	3,093	2,218	149	81	3,242	2,299
Coated free sheet	1,776	1,359	498	544	2,274	1,903
Uncoated free sheet[1]	7,384	4,837	1,816	2,624	9,200	7,461
Thin papers	106	57	263	301	369	358
Solid bleached bristols	946	1,092	123	73	1,069	1,165
Pkg. & ind. conv.	4,887	5,071	1,189	1,131	6,076	6,202
Tissue	2,606	2,043	2,519	2,457	5,125	4,500
Paperboard	**27,075**	**23,836**	**8,346**	**8,261**	**35,421**	**32,097**
Unbleached kraft	17,402	14,568	—	—	17,402	14,568
Solid bleached	4,121	3,998	2	—	4,123	3,998
Semichemical	5,207	4,758	—	—	5,207	4,758
Recycled	346	513	8,344	8,261	8,690	8,774
Construction paper & board[2]	**2,070**	**5,286**	**962**	**1,590**	**3,032**	**6,876**

1. Includes cotton fiber.
2. Includes hardpressed board in 1976 only.

Source: American Paper Institute.

PRODUCTION, EXPORTS/IMPORTS

Since the paper industry's fortunes are so closely tied to the health of the general economy, it is not surprising that the first half of the 1980s has been a period of sharp ups and downs for U.S. paper and paperboard production. Following a period of relatively steady growth after the recession of 1974-75, production peaked at 61.3 million tons in 1979 before dropping off slightly in the 1980 recession year, American Paper Institute statistics show. Production recovered somewhat in 1981, rising 1.8%, but another recession began in late 1981—the worst downturn in postwar years for the economy as a whole, although the 1974-75 recession was harder on paper industry production. Slumping along with the rest of the economy, production in 1982 fell 4.5% to 59.5 million tons, its lowest since 1978.

As sharp as the 1981-82 downturn was, however, the subsequent upturn in the economy has been even sharper. Dept. of Commerce data show that real gross national product, measured in constant 1972 dollars, contracted 1.5% in 1982. Real GNP grew 3.7% in 1983, the first year of the present recovery, and then took off in 1984, posting a gain of 6.8% for the year.

In response to the renewed demand, paper and paperboard production jumped to a record 65.0 million tons in 1983, up 9.3% compared with the depressed year-earlier levels and up 4.4% from the previous high of 62.3 million tons produced in 1981. Production rose an additional 5.8% in 1984 and reached a new high of 68.8 million tons, despite some weakening in the final quarter.

Highlighting the ups and downs of the early 1980s, the annual change in production levels for the 1980-84 period averaged 7.1%—compared with an average of minus 1.5% for 1980-82. In contrast, production growth averaged 2.3% in the 1960s and 3.9% in the 1970s.

As with production levels, industry operating rates showed steady year-to-year improvement in the late 1970s, reaching a peak of 94.9% in 1979. In 1980 and 1981, however, operating rates eroded slightly as the industry added new capacity at an above-average rate. Capacity additions increased 2.7% in 1980 and 1981, compared with average annual growth of 1% to 2% a year in the preceding five years. In 1982 new capacity climbed 2.8% at the same time as the recession depressed demand and caused heavy inventory reductions, and that combination sent operating rates for paper and paperboard plummeting to 84.8%, the lowest level since the 1975 recession. Operating rates have recovered quickly, however, thanks to the booming economy, rising to 91.4% in 1983 and 94.5% in 1984. In contrast, it took five years for capacity utilization rates to creep back up to prerecession levels following the 1974-75 downturn.

1984 production. Paper production tends to track general economic activity and is most closely tied to printing, advertising and the service sector of the economy. With those areas booming and GNP up 6.3% in real terms over 1983, U.S. paper production totaled a record 34.4 million tons in 1984, up 4.4% from a record 33.0 million tons in 1983, API data show.

Among the major paper grades, newsprint posted the largest gains, rising 7.3% to 5.5 million tons. Shipments of printing and writing papers climbed 5.8% in 1984 to 18.4 million tons after an explosive 11.4% increase the previous year. Tissue production rose to 4.9 million tons in 1984, a gain of 2.7%, after a 7.9% rise in 1983. Packaging and industrial paper grades, which have been under heavy competitive pressure from plastics, was the only category in which production declined year-to-year. Packaging paper production dropped 2.0% in 1984 to 5.6 million tons after rising 6.3% in 1983.

Paperboard as well as packaging and industrial papers tend to follow the trend of industrial production, which climbed 10.8% in 1984 on top of a 6.5% gain in 1983. U.S. paperboard production reached a record 34.4 million tons in 1984, a gain of 6.8% year-to-year, after rising 10.7% in 1983. All of the major paperboard grades registered solid increases in 1984 on top of big gains in 1983, when the economic recovery got going. Unbleached kraft linerboard production, which grew 11.2% in 1983, was up 6.9% in 1984 to 16.0 million tons, while semichemical medium posted a gain of 9.1% on the year, to 5.2 million tons, after a 7.8% rise in

U.S. PAPER & BOARD PRODUCTION BY MAJOR GRADE, 1980-84

	(000 short tons)					(Percent change)			
	1984	1983	1982	1981	1980	1984/83	1983/82	1982/81	1981/80
PAPER									
Newsprint	5,543	5,167	5,042	5,239	4,672	7.3%	2.5%	2.0%	12.1%
Printing/writing	18,397	17,387	15,611	15,736	15,577	5.8	11.4	−3.4	1.0
Uncoated groundwood (s)	1,566	1,531	1,471	1,463	1,498	2.3	4.1	−6.2	−2.3
Coated paper (s)	6,221	5,696	4,974	4,940	4,673	9.2	14.5	−0.5	5.7
Uncoated free sheet (s)	9,150	8,767	7,855	7,888	8,016	4.4	11.6	−4.2	2.5
Thin paper	338	328	329	336	333	3.0	−0.3	−0.4	0.9
Cotton fiber (s)	140	131	120	125	126	6.9	9.2	0.6	−0.9
Bleached bristol (s)	983	934	862	974	932	5.2	8.4	−9.0	4.5
Tissue paper	4,921	4,790	4,438	4,503	4,375	2.7	7.9	−3.1	2.9
Packaging & industrial converting (s)	5,551	5,633	5,300	5,556	5,576	−2.0	6.3	−8.9	−0.4
Unbleached kraft paper (s)	3,666	3,807	3,688	3,773	3,962	−3.7	3.2	−9.3	−2.2
Other paper	1,886	1,826	1,612	1,675	1,604	3.3	13.3	−7.8	4.3
Total paper	34,412	32,977	30,390	31,078	30,195	4.4	8.5	−3.5	2.8
PAPERBOARD									
Unbleached kraft linerboard	16,032	15,001	13,494	14,540	14,233	6.9	11.2	−7.9	2.2
Other unbl. kraft paperboard	1,147	1,121	1,040	1,062	1,063	2.3	7.8	−6.9	−0.1
Semichemical paperboard	5,162	4,730	4,389	4,723	4,719	9.1	7.8	−9.0	0.1
Solid bleached	4,059	3,926	3,665	3,910	3,862	3.4	7.1	−6.5	1.2
Recycled	7,971	7,398	6,476	7,601	7,071	7.7	14.2	−7.8	−1.0
Total paperboard	34,372	32,177	29,065	31,232	30,952	6.8	10.7	−7.8	0.9
TOTAL PAPER AND BOARD	68,784	65,154	59,456	62,260	61,147	5.6	9.6	−5.7	1.8
CONSTRUCTION & WET MACHINE	n.a.	n.a.	n.a.	2,129	2,558	—	—	n.a.	−16.7
TOTAL PAPER AND BOARD	n.a.	n.a.	n.a.	64,389	63,701	—	—	n.a.	−1.1

INDICATED OPERATING RATES FOR MAJOR GRADE SEGMENTS

	(production/annual capacity)				
PAPER					
Newsprint	94.8%	89.8%	89.2%	98.9%	96.6%
Printing/writing	93.0	94.1	87.6	90.8	92.7
Tissue	93.9	91.9	85.5	89.0	88.3
Packaging & indus. converting	92.7	93.9	87.7	93.3	91.7
Total paper	93.4	93.1	87.6	92.2	93.1
PAPERBOARD					
Unbleached kraft	101.2	93.4	84.7	97.7	95.8
Semichemical paperboard	98.9	90.1	83.2	95.4	95.4
Solid bleached board	96.9	93.5	88.3	97.4	92.4
Recycled paperboard	91.6	90.1	74.2	81.5	82.1
Total paperboard	95.7	90.1	81.9	91.2	91.8
TOTAL PAPER/PAPERBOARD	94.5	91.1	84.7	91.7	92.1
CONSTRUCTION & WET MACHINE	n.a.	n.a.	n.a.	49.9	58.8
TOTAL PAPER & BOARD	n.a.	n.a.	n.a.	88.9	90.1

1983. Recycled paperboard was up 7.7%, to 8.0 million tons, after a big jump of 14.2% in 1983. Solid bleached board climbed 3.4% to 4.1 million tons in 1984 following a 7.1% increase the previous year.

Woodpulp production through November 1984 was up 5.8% over 1983 on an annualized basis, to 55.9 million tons. Driven by the record production of paper, paper-grade pulp production climbed an annualized 6.5%, to 49.6 million tons. Market pulp got a boost in the domestic market from gains in tissue and printing and writing production, as well as increased demand for fluff pulp, API said. Market pulp rose 6.3% for the year on an annualized basis, to 6.2 million tons.

Industry outlook. Despite some weakening in the U.S. economy in late 1984—real GNP growth slowed to 3.9% in the fourth quarter compared with 7.1% earlier in the year—most observers expected moderate growth in paper and paperboard production in 1985. In a *Pulp & Paper* survey of analysts, real GNP growth forecasts averaged around 3.3% for 1985, while the consensus on paper and paperboard production was for 2.8% growth. That would boost production to approximately 70.7 million tons in 1985.

API forecast that real GNP would gain about 3.5% in 1985, and that industrial output growth would slow down markedly from the 10.8% pace of 1984 (industrial production was rising at a 5% to 6% annual rate in late 1984 and early 1985). Demand for printing and writing papers was expected to advance a little faster than GNP, while containerboard production for domestic use was seen rising 4% during the year, down from 9.2% growth in 1984. The consensus of analysts saw U.S. newsprint consumption rising 2% to 3% during 1985, down sharply from the 8.1% gain posted in 1984. The Canadian Pulp & Paper Assn. was even more bearish, however, predicting an increase of only 1% for the year.

EXPORTS/IMPORTS

Even with a pickup in overseas demand following the recession, U.S. exports have been hurt by the growing strength of the U.S. dollar. The dollar's value rose 10%

U.S. WOODPULP PRODUCTION BY MAJOR GRADES, 1978-84

(000 metric tons)

	1984*	1983	1982	1981	1980	1979	1978
TOTAL WOODPULP							
Bleached Sulfite	n.a.	1,185	1,127	1,272	1,324	1,250	1,289
Unbleached sulfite	n.a.	281	313	362	349	359	300
Total sulfite	n.a.	1,467	1,439	1,635	1,673	1,608	1,588
Bl. & semibl. softwood sulfate	n.a.	10,375	10,189	10,551	9,868	9,360	9,026
Bl. & semibl. hardwood sulfate	n.a.	8,772	7,702	7,647	7,369	7,024	6,499
Total bl. & semibl. sulfate	n.a.	19,147	17,891	18,198	17,236	16,384	15,521
Total white pulp	n.a.	20,614	19,330	19,833	18,909	17,992	17,113
Unbleached sulfate	n.a.	17,813	16,484	17,702	17,773	17,763	17,221
Total chemical paper-grade	40,835	38,427	35,814	37,535	36,683	35,755	34,376
Semichemical	3,683	3,494	3,356	3,560	3,652	3,681	3,432
Mechanical	5,046	4,597	4,594	4,826	4,324	3,984	3,756
Total paper-grade	49,564	46,518	43,764	45,920	44,657	43,421	41,564
Dissolving, special alpha	1,108	1,144	991	1,239	1,368	1,358	1,280
Total woodpulp	50,672	47,661	44,756	47,160	46,028	44,779	42,884
MARKET PULP							
Chemical paper-grade	5,116	4,721	4,212	4,402	4,457	3,733	3,306
Groundwood, other	13	0	0	1	62	57	69
Dissolving	1,107	1,143	988	1,213	1,366	1,361	1,275
Total market pulp	6,236	5,864	5,200	5,615	5,886	5,151	4,650
OPERATING RATES							
Total white pulp	n.a.	99.4%	94.6%	98.9%	96.9%	95.4%	92.9%
Total paper-grade	97.1	94.0	88.5	91.8	92.4	91.6	88.7
Dissolving/special alpha	81.2	78.6	68.0	86.5	95.5	92.8	86.1

* Annual rate for first eleven months of 1984.

Source: American Paper Institute.

in 1984, according to the Dept. of Commerce, pushing the U.S. trade deficit to a record $123.31 billion, up 77.4% over the $69.39 billion deficit—also a record—posted in 1983.

In 1980, the dollar reached its weakest point in a multi-year slide relative to other major currencies, and U.S. paper industry exports (including pulp, wastepaper and converted products) posted a huge 31.9% surge in volume to a record 11.8 million tons. In 1981, the dollar strengthened and recession began to affect major overseas markets, causing industry exports to fall 9.9%, although the value of shipments rose a modest 1.4%. In the 1982 recession year, exports fell an additional 7.4%, while the value of shipments plummeted 11.9% due to lower prices and the ever-stronger dollar. With both prices and demand up in 1983, paper industry exports rose 10.3% compared with a year earlier, but the value of those shipments actually declined, by 2.2%, because of the strong dollar.

In 1984, the dollar set records against major currencies, undercutting U.S. exports despite strong demand in overseas markets. Based on annualized data for the first 11 months, U.S. exports of paper and paperboard declined 3.4% in 1984 to 4.4 million tons. Total paper industry exports climbed 5.1% to 11.4 million tons, however, on the strength of a 26.8% rise in waste and old paper exports and a slight 0.7% gain in woodpulp volume.

Production of kraft linerboard for export fell 13.4% in 1984 to 2.0 million tons, API data show. On an annualized basis through November, kraft linerboard exports declined 7.7% to 2.1 million tons. Bleached

HISTORICAL U.S. PAPER AND PAPERBOARD PRODUCTION, IMPORTS, EXPORTS AND APPARENT CONSUMPTION 1950-84

	Production[1]	Imports[1]	Exports[1]	Apparent consumption[2]	Real GNP (billion 1972$)	Ratio consumption to real GNP (000 tons/bil.$)	Population (millions)	Per capita consumption (lb/capita)
1984	68,784	10,646[3]	4,372[3]	75,058	1,632.1[3]	46.00	236.6	633.0
1983	65,154	8,509	4,501	69,162	1,534.7	45.07	234.2	589.0
1982	59,456	7,306	4,187	62,575	1,480.0	42.28	232.0	543.0
1981	62,260	7,942	4,561	65,641	1,502.6	43.68	229.7	571.5
1980	61,147	8,304	5,148	64,303	1,474.0	43.62	227.7	564.8
1979	61,271	8,738	3,610	66,399	1,479.4	44.88	225.1	590.0
1978	58,744	8,781	3,301	64,224	1,438.6	44.64	222.6	557.0
1977	56,823	7,293	3,171	60,945	1,369.7	44.50	220.2	553.5
1976	55,150	7,042	3,388	58,804	1,298.2	45.30	218.0	539.5
1975	48,147	6,165	3,050	51,262	1,233.9	41.54	216.0	474.6
1974	55,926	7,970	3,720	60,176	1,248.0	48.22	213.9	562.7
1973	56,383	8,019	2,965	61,437	1,255.0	48.95	211.9	579.9
1972	53,886	7,567	3,019	58,434	1,185.9	49.27	209.9	556.8
1971	49,782	7,319	3,076	54,025	1,122.4	48.13	207.7	520.2
1970	48,758	7,057	2,780	53,035	1,085.6	48.85	205.1	517.2
1969	49,853	7,210	2,702	54,361	1,087.6	49.98	202.7	536.4
1968	47,110	6,792	2,587	51,315	1,058.1	48.50	200.7	511.4
1967	43,745	6,916	2,053	48,608	1,011.4	48.06	198.7	489.3
1966	43,904	7,327	1,903	49,328	948.8	51.99	196.6	501.8
1965	40,489	6,549	1,736	45,302	929.3	48.75	194.3	466.3
1964	39,066	6,154	1,661	43,559	876.4	49.70	191.9	454.0
1963	35,914	5,637	1,302	40,249	832.5	48.35	189.2	425.5
1962	34,407	5,719	1,154	38,922	800.3	48.63	186.5	417.4
1961	32,548	5,663	1,175	37,036	756.6	48.95	183.7	403.2
1960	31,221	5,610	990	35,841	737.2	48.62	180.7	396.7
1955	26,772	5,313	805	31,280	657.5	47.57	165.9	377.1
1950	21,563	4,973	337	26,199	534.8	48.99	152.3	344.0

1. Excludes wet machine board, construction paper and board, and hard pressed board.
2. Apparent consumption (new supply) = production + imports − exports.
3. Annual rate for first eleven months.

Source: American Paper Institute, Dept. of Commerce.

paperboard exports climbed to 566,000 tons, a gain of 1.0%, while recycled paperboard posted a 7.9% increase, to 166,000 tons, the annualized data show. The export volume of newsprint also improved, gaining 5.0% to 311,000 tons.

Imports break records. While depressing U.S. exports, the strong U.S. dollar coupled with the booming economic expansion of the past two years has encouraged a flood of imports into the U.S. Annualized API data through November show that total U.S. paper imports (including pulp, wastepaper and converted products) jumped 19.4% in 1984 compared with the previous year, to a record 15.8 million tons.

Imports of paper and paperboard soared 25.4% in 1984, to a record 10.4 million tons. In newsprint, the largest import category, volume was up 14.7% to 7.9 million tons, the annualized data show. Imports of Canadian newsprint were up 9.2% on the year to 6.6 million tons, according to the CPPA. This brings Canada's share of U.S. newsprint consumption to about 57.7%, up from a low of 55.4% in 1982. Canada's share of total U.S. newsprint supply has declined over the long term, falling from 70% in 1962 to 64% in 1972 and 57.5% in 1981.

Among other major grades, the annualized API results show woodpulp imports of 4.4 million tons in 1984, up 8.7% over 1983. The largest increase came in printing and writing papers, which shot up 85.2% to 2.1 million tons in response to heavy U.S. demand. Paperboard volume jumped 46.5% to 244 million tons, while imports of converted products increased by 49.1%, to 223,000 tons.

Trade deficit widens. U.S. industry exports grew at an annual rate of 5.3% in the 1970s, while import tonnage increased an average 1.3%/year over the same period. That long-term trend toward a balanced trade account has been interrupted, if not halted, by the skyrocketing dollar, however. In tonnage terms, the U.S. industry's net trade deficit grew a whopping 93.1% in 1984 to finish the year at 4.4 million tons, according to annualized data through November. That performance follows an increase of 21.7% in the 1983 deficit, to 2.3 million tons. In dollar terms, the trade deficit was $1.4 million in 1983 (the latest year for which value of shipment data is available), a 39.1% increase over 1982.

Apparent U.S. consumption of paper and paperboard (defined as production plus imports minus export) rose a strong 8.5% to 75.1 million tons in 1984. Apparent

HISTORICAL U.S. WOODPULP PRODUCTION, CAPACITY AND OPERATING RATES

(000 metric tons)

	Production* Total	Captive	Market	Total* capacity	Operating rate
1984[1]	50,672	44,438	6,234	51,807	98%
1983	47,661	41,784	5,876	50,959	94
1982	44,756	39,555	5,200	50,881	88
1981	47,160	41,545	5,615	49,812	95
1980	46,028	40,142	5,886	48,536	95
1979	44,781	39,631	5,151	47,328	95
1978	43,032	38,385	4,647	46,018	94
1977	42,319	37,961	4,358	45,688	93
1976	41,187	36,774	4,413	44,653	92
1975	36,838	32,885	3,953	43,635	84
1974	40,676	36,014	4,663	41,352	98
1973	41,084	36,617	4,468	42,718	96
1972	39,544	34,985	4,559	41,191	96
1971	37,211	33,008	4,204	40,402	92
1970	37,050	32,110	4,941	39,538	94
1965	28,855	25,369	3,486	30,989	93
1960	21,755	19,038	2,717	25,646	85
1955	17,570	15,141	2,429	18,955	93
1950	12,447	10,933	1,454	13,622	91

1. Annualized rate for first eleven months.

* Includes paper-grade, dissolving/special alpha pulps, but excludes defibrated/exploded pulps, screenings and fiber other than wood.

Source: American Paper Institute Pulp & Raw Materials Group.

consumption in 1983 of 69.2 million tons was up 10.5% compared with 1982. In comparison, apparent consumption jumped 14.7% in 1976 following the last major recession.

The ratio of apparent consumption per billion dollars of real GNP has grown sharply over the past two years, rising from the recession low of 42,280 tons in 1982—near the low of 41,540 recorded in 1975—to 45,070 tons in 1983 and 46,000 tons in 1984, the highest levels since the mid-1970s. Before the 1975 recession, the ratio averaged around 48,000 to 49,000 tons. Between that recession and the current recovery, however, apparent consumption averaged 43,000 to 44,000 tons per billion dollars of real GNP, probably reflecting lower demand caused by a sharp rise in paper prices in the 1974-75 period and some plastic substitution for paper in the packaging segment of the industry.

HISTORICAL U.S. PAPER AND BOARD PRODUCTION, CAPACITY AND OPERATING RATES, 1960-84

	Production				Capacity		Operating rate
	Paper	Paper board	Total paper/ board[1]	% change	Total paper/ board[1]	% change	Total paper/ board
1984	34,412	34,372	68,784	5.8%	72,749	2.3%	94.5%
1983	32,833	32,177	65,010	9.3	71,126	1.5	91.4
1982	30,390	29,065	59,455	−4.5	70,086	2.8	84.8
1981	31,028	31,232	62,620	1.8	68,172	2.7	91.3
1980	30,195	30,952	61,147	−0.3	66,368	2.7	92.1
1979	29,890	31,429	61,319	4.4	64,615	2.4	94.9
1978	28,458	30,275	58,733	3.4	63,091	1.8	93.1
1977	27,870	28,953	56,823	3.2	62,004	1.1	91.6
1976	26,608	28,440	55,048	14.3	61,307	1.9	89.8
1975	23,391	24,756	48,147	−13.9	60,140	1.0	80.1
1974	27,011	28,915	55.926	−0.8	59,527	2.3	94.0
1973	26,811	29,571	56,382	4.6	58.164	4.1	96.9
1972	25,383	28,502	53,885	8.2	55,873	3.2	96.4
1971	23,745	26,037	49,782	2.1	54,136	1.6	92.0
1970	23,375	25,383	48,758	−2.2	53,260	0.3	91.5
1969	23,477	26,376	49,853	5.8	53,094	3.8	93.9
1968	22,206	24,904	47,110	7.7	51,147	4.7	92.1
1967	20,926	22,819	43,745	−0.4	48,850	4.8	89.5
1966	20,725	23,179	43,904	8.4	46,608	7.1	94.2
1965	19,157	21,332	40,489	6.4	43,535	4.6	93.0
1964	18,112	19,954	38,066	6.0	41,623	3.7	91.5
1963	17,320	18,594	35,914	4.4	40,143	3.4	89.5
1962	16,560	17,847	34,407	5.7	38,810	1.3	88.7
1961	15,821	16,727	32,548	4.3	38,299	4.0	85.0
1960	15,295	15,926	31,221	15.4	36,840	3.1	84.7
Average annual change 1984-80				7.1%		3.1%	
1979-70				3.9		3.6	
1969-60				2.3		2.0	

1. Excludes hardpressed board, construction paper and board and wet machine board.

Source: American Paper Institute (Bureau of the Census for total paper/board production usually lower (000 tons): 1980—63,864; 1979—62,752; 1978—62,006; 1977—60,485; 1976—57,788).

INVENTORY LEVELS FOR PULP, NEWSPRINT AND CONTAINERBOARD

	Norscan producer[1] pulp stocks (000 metric tons)	U.S. consumer newsprint stocks[2]		U.S. containerboard inventories[3]	
		(000 metric tons)	(days)	(000 short tons)	(weeks)
1984					
Dec	1,621	1,342	45	2,649	7.1
Sept	1,298	1,480	43	2,711	7.0
June	1,042	1,400	48	2,540	6.5
Mar	917	1,234	40	2,466	6.3
1983					
Dec	1,201	1,187	42	2,415	6.5
Sept	1,524	1,303	40	2,421	6.6
June	1,414	1,258	47	2,463	6.7
Mar	1,572	1,248	44	2,367	7.2
1982					
Dec	1,602	1,269	47	2,524	7.6
Sept	1,750	1,417	48	2,540	7.4
June	1,873	1,564	61	2,634	7.9
Mar	1,172	1,671	59	2,570	7.4
Year end					
1981	1,430	1,477	56	2,729	9.4
1980	948	1,090	42	1,984	6.2
1979	614	877	34	1,979	6.2
1978	879	970	38	1,961	5.8
1977	2,223	1,071	43	2,437	7.2
1976	2,825	1,209	52	2,527	8.1
1975	2,011	911	44	2,185	7.2
1974	611	1,061	48	2,323	8.2
1973	629	757	32	1,595	4.7
1972	1,149	667	26	1,603	5.1
1971	1,618	885	38	1,639	5.7
1970	647	944	42	1,879	7.0
Year-end average					
1983-70	1,313	935	40	2,013	6.5

1. Chemical paper-grade market pulp stocks at North American/Scandinavian producer mills (source: American Paper Institute).
2. Estimated U.S. publisher stocks of newsprint and days of supply (source: Canadian Pulp & Paper Assn.).
3. Containerboard inventories at box plants and mills and weeks of supply (source: Fibre Box Assn.).

TOP U.S. STATES IN PULP, PAPER AND PAPERBOARD PRODUCTION, 1982

(000 short tons)

PULP		PAPER		PAPERBOARD	
1. Georgia	5,414	1. Wisconsin	3,459	1. Virginia	1,706
2. Alabama	4,873	2. Maine	3,137	2. Tennessee	1,175
3. Washington	3,274	3. Alabama	1,944	3. Ohio	1,014
4. Louisiana	3,249	4. New York	1,441	4. Texas	999
5. Florida	3,095	5. Pennsylvania	1,399	5. California	774
6. Texas	2,735	6. Oregon	1,366	6. Pennsylvania	585
7. North Carolina	2,725	7. Louisiana	1,348	7. Indiana	515
8. Maine	2,611	8. Georgia	946	8. Illinois	458
9. Virginia	2,563	9. Michigan	913	9. Massachusetts	177
10. Oregon	2,489	10. Minnesota	856		

Note: Production figures for several top producing states are excluded by the Dept. of Commerce to avoid revealing data for individual companies, biasing the list above against states with a small number of major producers. Such states include Florida, Georgia, Louisiana, North Carolina, Oregon, South Carolina and Washington.

Source: Bureau of the Census.

U.S. PAPER INDUSTRY EXPORT TONNAGE BY AREAS OF DESTINATION

(% distribution)

	1983	1972
	Paper, paperboard and converted products	
Western Europe	22.0%	41.0%
Canada	14.4	13.6
Latin America	22.7	25.8
Middle East & Africa	11.0	8.9
Japan	12.3	1.0
Oceania & Far East	13.1	9.1
Other	4.5	0.6
Total (short tons)	**4,568,907**	**3,103,738**
	Woodpulp	
Western Europe	48.3	47.4
Canada	—	4.6
Latin America	9.6	14.3
Middle East & Africa	3.4	4.0
Japan	19.7	16.5
Oceania & Far East	15.2	10.7
Other	3.9	2.5
Total (short tons)	**3,643,963**	**2,252,778**

Source: American Paper Institute; Dept. of Commerce.

U.S. PAPER INDUSTRY EXPORTS, IMPORTS AND NET TRADE BALANCE

	1983		1982		1981		1972	
	Tons (000)	Value ($ million)	Tons (000)	Value ($ million)	Tons (000)	Value ($ million)	Tons (000)	Value ($ million)
Exports								
Woodpulp	3,643	$1,362	3,395	$1,415	3,678	$1,661	2,253	$ 358
Paper	774	600	840	679	1,009	847	558	243
Newsprint	295	127	308	143	270	140	144	20
Printing/writing	202	198	247	239	383	355	171	210
Packaging, tissue, other	277	274	286	297	355	353	204	97
Paperboard	3,143	1,086	2,771	1,045	2,946	1,196	2,299	328
Linerboard	2,255	576	1,886	542	1,973	660	1,877	235
Bleached paperboard	558	371	526	350	584	368	209	47
Other paperboard	107	52	139	61	389	168	213	46
Total paper/paperboard	3,917	1,686	3,611	1,724	3,954	2,042	2,857	571
Converted products	584	763	576	835	607	811	161	105
Construction & wet machine	56	27	48	24	80	38	85	20
Wastepaper	2,574	309	2,127	239	2,213	269	415	21
Total industry exports	10,889	4,230	9,872	4,324	10,663	4,906	5,827	1,089
Imports								
Woodpulp	4,093	1,472	3,666	1,493	4,087	1,754	3,728	$ 494
Paper	8,189	3,429	7,381	3,226	7,716	3,248	7,520	1,138
Newsprint	6,919	2,757	6,531	2,749	6,977	2,825	7,101	1,056
Printing/writing	1,151	587	764	409	639	347	258	48
Packaging, tissue, other	119	84	86	69	101	76	149	24
Paperboard	169	46	115	30	131	35	8	2
Total paper/paperboard	8,357	3,475	7,496	3,256	7,847	3,283	7,528	1,140
Converted products	152	437	107	338	95	310	39	33
Construction & wet machine	474	105	420	87	398	79	465	42
Wastepaper	100	11	74	9	79	11	133	12
Total industry imports	13,180	5,650	11,754	5,345	12,561	5,459	11,894	1,721
Net trade balance (deficit)								
Woodpulp	(450)	(110)	(271)	(78)	(409)	(93)	(1,475)	(136)
Paper/paperboard	(4,440)	(1,789)	(3,885)	(1,532)	(3,893)	(1,241)	(4,671)	(569)
Total industry	(2,291)	(1,420)	(1,882)	(1,021)	(1,898)	(553)	(6,067)	(632)

Source: American Paper Institute, Dept. of Commerce.

PRICES

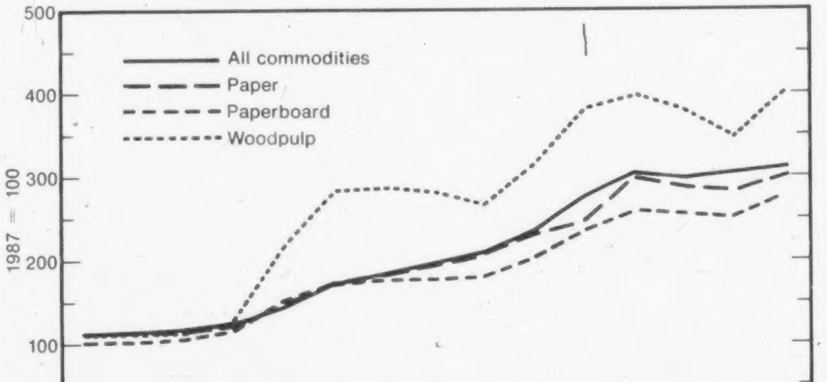
Prices for paper, paperboard and converted products tend to weaken or decline in recessions and rise strongly in economic recoveries. Fiber prices are even more cyclical, with wastepaper tending to lead economic cycles and woodpulp to lag them.

The rate of increase in paper prices slowed in the last recession and then declined 1.5% in 1983, while paperboard prices dropped 1.2% in 1982 and 1.7% in 1983, according to Bureau of Labor Statistics indexes (which understate the actual extent of the decline). Converted products fared somewhat better. Prices rose 2.1% in 1982 and 0.4% in 1983, giving independent converters an opportunity to improve their profit margins during the downturn. Market pulp prices tumbled 5.2% in 1982 and 8.5% in 1983, while wastepaper prices declined 15.9% in 1981 and 31.0% in 1982 before recovering 15.3% in 1983. The sharp decline in fiber costs was helpful to nonintegrated mills, which tend to be smaller and less competitive.

Paper industry prices have climbed over the past decade at about the same rate as the overall producer price index, according to the BLS. While the index for all commodities rose an average of 8.6%/year from 1974 to 1983, the pulp index climbed 12.4%/year, paper 9.0%, paperboard 8.5%, and converted products 8.3%. Wastepaper lagged significantly, rising just 2.5%/year, but this average excludes sharp rises in wastepaper prices in 1973 and 1984.

Pulp ups and downs. Pulp prices are highly cyclical and tend to lag upturns and downturns in the world economy by as much as two years. One reason is that integrated producers tend to be net buyers of pulp in strong markets but net sellers in weak markets, causing sharp fluctuations in supply and demand. Other factors

PAPER INDUSTRY PRICE INDEXES vs ALL COMMODITIES
1970-1984



include inventory levels held by North American and Scandinavian producers, operating rates, and changes in average manufacturing costs. Historically, pulp prices have tended to rise when ratios of shipments-to-capacity reach about 87% to 88% and when Norscan producers' inventories have dropped to around 1.2 million tons or lower. Exchange rate fluctuations have also had a growing impact on pulp prices, which are mainly quoted in U.S. dollars.

Following a decade of stability, pulp pricing changed drastically in the 1970s as the result of growing market tightness and a sharp escalation in production costs—particularly for energy and wood—in the 1973-74 and 1978-80 periods. And after reaching a low of about $330/ton in the 1978 downturn, benchmark northern bleached softwood kraft (NBSK) list prices rose for eight consecutive quarters, hitting $545/metric ton (c.i.f. northern Europe) by 1980. This represented a 68% rise from the 1977 trough.

Subsequent attempts to raise prices proved unsuccessful, however, and the official $545 list price that had been in effect for two years broke in the second quarter of 1982, hitting a low of around $400 to $410/ton in the first quarter of 1983. The 26% decline was even worse than the 1977-78 drop in pulp prices.

With some improvement in demand, producers were partially successful in boosting the price of NBSK to $440 in the second quarter of 1983. Price increases on southern pine and hardwood grades were somewhat more successful, closing the large price gap that had developed with NBSK.

Producers encountered considerable customer resistance to another $50/ton increase in the first quarter of 1984, but a new list price of $490/metric ton began to firm after a labor dispute in British Columbia shut down about 22% of Norscan production. Encouraged by tightening markets, still financially strapped producers pushed through another $50/ton increase for the second quarter, resulting in an unprecedented 22.7% rise to $540/metric ton.

The new list prices, however, came under increasing discounting pressure in the third and fourth quarters of 1984 due to the strong dollar, customer inventory liquidation, high production levels at existing mills, and the

PRICE INDEXES FOR U.S. PULP, PAPER & PRODUCTS vs ALL INDUSTRIAL COMMODITIES

(1967 = 100)

	All industrial commodities	Pulp, paper & products*	Woodpulp	Wastepaper	Paper	Paper board	Converted products
1984 1st half	311.4	293.3	401.7	258.5	301.1	277.1	279.78
% change	+ 2.7%	+ 8.1%	+ 14.5%	+ 85.0%	+ 6.8%	+ 10.6%	+ 5.4%
1983	303.1	271.4	346.7	139.7	281.9	250.5	265.4
% change	+ 1.3%	− 0.7%	− 8.5%	+ 15.3%	− 1.5%	− 1.7%	+ 0.4%
1982	299.3	273.2	379.0	121.2	286.3	254.9	264.4
% change	− 1.6%	+ 0.9%	− 5.2%	− 31.0%	+ 2.2%	− 1.2%	+ 2.1%
1981	301.4	270.8	397.1	175.7	279.8	258.1	258.8
1980	274.8	250.6	380.3	208.7	256.8	234.6	238.5
1979	236.3	220.2	314.3	206.6	229.7	202.1	209.6
1978	209.4	195.5	266.5	191.2	206.1	179.4	186.3
1977	195.1	187.4	281.1	187.2	194.3	176.5	176.5
1976	182.3	180.8	286.0	184.9	182.2	176.3	170.0
1975	171.5	171.9	283.4	110.2	172.9	170.3	161.8
1974	153.8	152.8	217.8	265.5	148.6	152.2	144.9
1973	125.9	122.5	128.3	197.4	121.4	115.1	121.6
1972	117.9	113.7	111.5	133.6	116.3	105.5	113.6
1971	114.0	110.4	112.0	112.1	114.1	102.4	109.7
1970	110.0	108.5	109.5	125.0	111.0	101.1	107.9
Average annual rate 1970-81	+ 9.8%	+ 8.9%	+ 14.0%	+ 8.8%	+ 8.9%	+ 9.2%	+ 8.4%

* Excludes construction grades.

Source: Bureau of Labor Statistics.

SELECTED U.S. PULP, PAPER AND CONVERTED PRODUCT PRICES

	$/short ton domestic market—unless otherwise indicated					Percentage change from a year earlier			
	2nd Q 1984	4th Q 1983	4th Q 1982	4th Q 1981	4th Q 1980	4th Q 1984	4th Q 1983	4th Q 1982	4th Q 1981
PULP									
Bleached softwood kraft—northern	$ 490*	$ 399*	$ 399	$481/513	$ 481	−22.8%	—	−19.7%	+ 3.3%
Bleached softwood kraft—southern	467*	376/381*	350*	450	460	22.6	+ 8.9	−22.2	− 2.2
Bleached hardwood kraft—southern	454/463	372/381	330/345*	425/445*	445	22.8	+ 11.2	−22.3	− 2.2
PAPER									
Newsprint (30 lb-East)	453	453*	453*/425	453	400/426	—	3.2	− 3.1	+ 9.7
Directory (22.5 lb white)	670	650	650	578	535	3.1	—	+ 12.5	+ 8.0
Coated publication paper									
No. 1 (+70 lb sheets)	1,310	1,250	1,200	1,130	1,038	4.8	4.2	6.2	8.9
No. 5 (32-36 lb rolls)	830	782	760*	760	735	6.1	2.9	—	3.4
Uncoated free-sheet									
Book paper (No. 3 offset, +45 lb sheets)	900	840	680*	878*	785/813	7.1	23.5	−22.6	9.9
No. 1 (watermarked, +20-lb sheets)	985	960	916*	916*	802/848	2.6	4.8	—	11.0
Forms bond (15-lb rolls)	795	745	640*	753*	643/697	6.7	16.4	15.0	12.4
Tissue (BLS index)	362	360	361	348	339	0.6	− 0.3	3.7	2.7
Unbleached kraft shipping sack (+50 lb)	440*	380/410	360/380	405	375	11.4	6.8	− 8.6	8.0
PAPERBOARD									
Unbleached kraft linerboard (42-lb East)	320	290	250/260*	270/300*	270	10.3	13.7	−10.5	5.6
Semichemical medium (26-lb East)	310	280	240/250*	260/290*	260	10.7	14.3	−10.9	5.8
Folding boxboard									
Clay-coated recycled (20-pt rolls)	370/425	370/425	380/425	400/425	380/400	—	− 1.2	− 2.4	5.8
Solid bleached sulfate (15 pt, C1S, 80 brite, rolls)	625	590/625	590/625	625	550	2.9	—	− 2.8	13.6
CONSTRUCTION GRADES									
Insulation board (½-in./100ft²)	92.45	90.73	88.96	85.79	76.65	1.9	2.0	3.7	11.9
CONVERTED PRODUCTS									
Corrugated price trend (FBA index)	40.87	37.74	37.15	39.05	35.99	8.3	1.6	− 4.9	8.5

* = Discounting below list prices.
— = no change.

Source: PULP & PAPER WEEK, Bureau of Labor Statistics, Fibre Box Assn.

startup of new pulp mills. Early in the fourth quarter, paper-grade pulp prices in Europe were being discounted by roughly $40 to $50/ton from list levels and there was concern among producers that they might have to give up a large portion of their earlier increase.

Paper—the best performer. Paper prices weathered the last recession better than other industry products, BLS data show. The BLS paper price index rose 9.0% in 1981 and 2.2% in 1982 before falling 1.5% in 1983. The index rebounded 6.8% through the first half of 1984, but later in the year the pace of increases slowed considerably, with discounting in some grades as the economy cooled down and the strong dollar continued to work against U.S. producers.

In October 1982, newsprint prices fell for the first time since the Great Depression, dropping from the $453/short-ton list established in mid-1981 to $425. Overcapacity forced the dropoff, while competition from other publication grades—also selling for less because of overcapacity—made already soft markets worse. The recovery boosted consumption, allowing producers to push the list price back up to $453 in mid-1983, but transaction prices did not firm to that level until the 10-week British Columbia shutdown in the first quarter of 1984. List price was raised again in mid-1984, to $484/short ton, but it was unclear how much tonnage was actually moving at the new price. With U.S. consumption very strong, another increase was expected sometime in early 1985, although a $35/metric-ton increase announced in October by industry leader Abitibi-Price Inc. for Jan. 1 was quickly withdrawn for lack of support.

Uncoated groundwood prices have been bolstered by strong pricing and heavy demand for coated papers, allowing producers to restore prices to prerecession levels and better. Heavy demand kept the coated groundwood industry running virtually flat out in the late 1970s, allowing a steady series of price increases following the 1974-75 recession. A heavy influx of new capacity and lower demand because of the recession caused prices to flatten in 1981 and 1982, however, and forced a price rollback in early 1983. But demand quickly outpaced new capacity as the recovery picked up steam, allowing producers to restore prices and push through two increases in 1984. Coated groundwood prices in July 1984 were up over 20% compared with year-earlier levels, with business expected to remain firm into 1985. Demand for coated free sheet has been almost as strong as for coated groundwood, although free sheet is more subject to seasonal ups and downs. Coated free-sheet mills raised prices in the fourth quarter of 1983, again in January 1984, and again in the second quarter.

Uncoated free-sheet prices came under heavy pressure during the recession, with deep cuts in prices for all but the premium grades. As with coated papers, however, the booming recovery allowed producers to regain lost ground. Prices went up in the last quarter of 1983 and again on Jan. 1, 1984. Business softened somewhat in the second quarter, however, and an attempted increase for July 1 failed to materialize. Significant new capacity from Union Camp Corp. and Crown Zellerbach Corp. has since come online, further eroding markets.

Unbleached kraft paper has been the weakest segment in recent years, particularly the heavier-weight grades which are subject to competitive pressure from swing linerboard machines producing kraft papers during slow periods. Prices for 70-lb grocery sack paper fell from a prerecession peak of about $310/short ton to a discounted $240 in late 1982. Multiwall kraft sack paper also suffered during the downturn due to weakness in such key markets as construction and agriculture. Prices picked up along with the economy in 1983, however, as swing machines returned to linerboard production and inventories dropped to more normal levels. With mills running full, producers were able to push through sharp runups in some grades. Grocery sack prices surpassed prerecession levels in early 1984, and further increases brought prices into parity with lightweight linerboard by early summer. Despite softness during the slower summer months after the sharp increases earlier in the year, producers hoped to follow a fall linerboard price increase with one of their own. Increasing softness in linerboard markets was expected to undermine that attempt, however. The price outlook over the longer term remains favorable because of capacity shutdowns that are expected to keep supplies tight.

Paperboard hit hard. Paperboard prices climbed 16.0% in 1980 and 10.0% in 1981 before falling off 1.2% in 1982 and 1.7% in 1983, according to the BLS. Prices rebounded 10.6% through the first half of 1984. Both linerboard and corrugating medium suffered sharp drops during the recession, with 42-lb linerboard prices falling from $300/ton in early 1981 to $250 and lower by late 1982 and medium taking a similar plunge. Prices began climbing again in 1983, but producers were not able to regain old levels until a February 1984 hike to $320/ton. Although markets began to soften during the summer due to high production and excess inventories, producers pushed through a second $30/ton increase, to $350, for Sept. 1.

Although more recession-proof than other grades because of various end uses in food packaging, solid bleached folding boxboard prices also fell in 1982, in part because of competition from clay-coated recycled boxboard mills benefiting from the sharp decline in wastepaper prices. Markets began to recover in 1983, sending prices up late in the year. The old list of $625/ton was reestablished in the first half of 1984, although transaction prices were lower. Another price increase for later in the year was expected by some observers, if only to firm up transaction prices.

Wastepaper prices are among the most volatile in the paper industry, tending to fluctuate wildly in response to supply and demand. Prices dropped through the floor in the past recession, falling 15.9% in 1981 and 31.0% in 1982, according to BLS. But prices recovered just as quickly along with the economy, climbing 85% in the first half of 1984. After that steep runup, however, prices stabilized during the summer months and were expected to decline somewhat later in the year.

Converted prices steady. Converted product prices have been more stable than primary grades, holding up better during the recession but missing out on the strong recovery afterwards. Converted product price indexes rose 2.1% in 1982 and 0.4% in 1983, BLS statistics show. Prices since then have not kept pace with increases on paper and paperboard, however. Statistics through July 1984 show converted product price indexes up 6.6% from a year earlier, compared with a rise of 10.8% in the paper index and 11.9% for paperboard over the same period, indicating that converters have had trouble matching the pace of paper and board price increases.

Paper and board represent the largest cost for converters—about 55% in the case of corrugated boxes. But other converting costs, such as unit labor costs and energy, have been rising at a much slower rate, indicating that converters may not be in a serious profit squeeze even though they are not matching the rate of price increases for paper and paperboard.

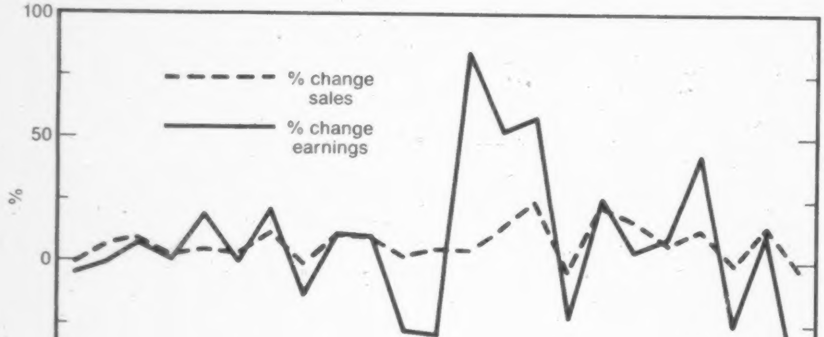
PROFITABILITY

Nineteen-eighty-four is shaping up as a banner year for profits in the U.S. paper industry, as high volumes, a series of successful price hikes, and relatively moderate cost increases have combined to restore badly eroded profit margins. Analysts expect on average a 70% jump in U.S. paper company income from operations in 1984—which if realized would be the sharpest increase in the postwar period. Forest products companies—those with large solid-wood operations in addition to their paper businesses—will enjoy a 67% increase in profits, analysts estimate. Forest products company profits will come mainly from paper operations, however, due to depressed lumber and plywood prices. Preliminary data for the U.S. paper and allied products industry show annualized earnings for 1984 up 43% compared to last year, on sales up 13%, according to the Federal Trade Commission.

The present gain in earnings follows the worst recession in postwar history. Earnings declined almost 63% between 1980 and 1983, *Pulp & Paper Week* surveys show. FTC data show U.S. paper and allied products earnings off 53% in 1982 alone, twice the decline of the 21% suffered in the 1974-75 recession and on a par with the recession of 1970-71, when profits tumbled 56% over the two-year period.

Forest products operations were the first hit in the recent recession, when the worst housing decline since World War II began rolling in 1979. Profits on the paper side began to evaporate in the fourth quarter of 1981, as weak demand forced sharp price discounting in major grades. Paper company net income declined 8% in 1981 on sales up 6% from a year earlier, while forest products companies suffered a 28% drop in earnings for the year. In the depths of the recession in 1982, paper

SALES AND EARNINGS PERFORMANCE, 1960-1982



Source: Federal Trade Commission.

U.S. PAPER AND FOREST PRODUCT COMPANY SALES AND EARNINGS FOR 1983

(000 dollars)

Paper companies	Sales	% change 1983/82	Earnings[1]	% change 1983/82
Chesapeake	$ 273,735	14.1%	$ 8,470	4.6%
Consolidated Papers	573,346	8.1	48,975	8.8
Crown Zellerbach	2,708,600	−8.1[2]	87,800	585.9[2]
Federal Paper Board	568,999	11.6	12,458	−22.5
Fort Howard Paper	785,976	46.4	106,980	15.8
P.H. Glatfelter	257,091	3.9	20,583	3.5
GN Nekoosa	1,565,000	9.5	84,000	−7.0
Hammermill Paper	1,622,695	16.2	32,548	7.6
International Paper	4,357,100	8.5	254,900	58.5[4]
James River	1,656,112	114.3	55,148	146.7
Kimberly-Clark	3,274,300	11.1	188,800	−4.4[6]
Longview Fibre (10/31)[5]	373,391	0.5	17,321	386.7
Mead	2,366,600	11.2	30,000	n.m.[3]
Mosinee[7]	129,507	52.4	7,095	79.0
Pentair	319,289	17.8	11,916	13.4
St. Regis Paper	2,774,578	8.6	55,181	22.5
Scott Paper	2,465,088	7.5	123,679	66.1
Sonoco Products	668,628	24.1[8]	33,534	17.3
Stone Container	655,847	53.7	(2,922)	n.m.
SW Forest Industries	636,415	19.2	(29,821)	n.m.
Union Camp	1,688,254	17.6[8]	132,736	7.0
Westvaco (10/31)[5]	1,493,412	3.0	62,789	−0.5
Willamette Industries	1,045,669	12.6	18,197	240.4
Total	**32,259,650**	**14.9**	**1,360,367**	**40.7**
Forest products				
Boise Cascade	3,450,890	18.5	60,380	732.8
Champion Intl.	4,263,999	14.1	82.160	107.2
Georgia-Pacific	6,469,000	19.8	105,000	101.9
Louisiana-Pacific	1,101,980	26.3	23.120	n.m.[3]
Pope & Talbot	287,684	11.6	10,887	151.6
Potlatch	906,745	10.6	40,467	79.6
Weyerhaeuser	4,882,629	16.6	204,843	21.3
Total	**21,362,927**	**17.5**	**526,857**	**89.5**
U.S. total	**53,622,577**	**15.9**	**1,887,224**	**51.6**

1. Income after taxes from continuing operations, excluding most significant nonrecurring items in both years.
2. 1982 sales include CZ Canada interest sold effective Dec. 31, 1982. Earnings do not include net after-tax charge of $125 million from CZ Canada sale and restructuring of domestic operations.
3. Not meaningful due to loss in 1982.
4. 1982 income includes pretax gain of $26.7 million from sale of tax benefits. 1983 income includes pretax gains of $60.2 million from land sale and $63.5 million from sale of timber.
5. Period ended.
6. 1982 earnings include $13.9-million gain from exchange of securities and $8.3-million gain from woodlands sale.
7. Includes results of Sorg Paper Co., acquired in August 1983.
8. 1982 figures restated by company.

( ) = Loss. n.m. = Not meaningful.

Source: PULP & PAPER WEEK.

company profits plummeted an additional 47% on sales that were off 7%, while forest products income plunged 65%, *P&PW* data show.

After six consecutive quarters of decline, paper industry earnings began to show faint signs of recovery in the second quarter of 1983, rising 6% above year-earlier levels. Forest products companies got a much-needed lift from a jump in housing starts and higher prices for building materials, which boosted profits 73% above 1982 levels. Although lumber prices collapsed in the third quarter due to overcapacity, paper shipments—and prices—improved steadily, and paper and forest products companies posted increases of 34% and 90%, respectively. As the economic recovery gathered steam late in the year, industry profits took off, rising six-fold among paper companies and almost ten-fold for forest products firms. U.S. paper companies finished the year with profits up 45% compared to 1982, while forest products firms enjoyed a 90% increase.

Profits continued to improve dramatically as the economy boomed in early 1984, and a number of companies set new records for sales and earnings. Paper companies posted a 59% increase in first-quarter net income, while forest products producers' net rose 66% compared to 1983. Second-quarter figures were even more spectacular as paper company profits jumped 88% compared with the year before on sales up 32%, and forest products firms reported a 78% rise in net income. Most CEOs were optimistic about continued profitability improvements in the second half and on into 1985.

Historical performance. After lagging the average for all manufacturing for two decades, paper industry

U.S. PAPER & ALLIED PRODUCTS INDUSTRY FINANCIAL PERFORMANCE, 1960-82

(Dollar figures are millions)

					Financial Ratio			
	Net sales	% change from prior yr	Net profit after taxes	% change from prior yr	Profit margins	Return on net worth	Return on total capital	Debt to net worth
1982	$60,295	−3.5%	$1,460	−52.9%	2.4%	5.5%	3.7	49.2
1981*	62,500	+14.1	3,100	+11.5	5.0	12.1	8.2	44.0
1980*	54,737	− 1.1	2,781	−25.3	5.1	11.6	8.1	43.4
1979	55,359	+13.0	3,723	+43.3	6.7	16.0	10.9	47.5
1978*	48,982	+ 7.1	2,598	+ 9.8	5.3	12.5	8.5	47.6
1977*	45,750	+16.5	2,367	+ 4.3	5.2	12.0	8.2	47.0
1976	39,270	+22.6	2,270	+26.0	5.8	13.2	9.1	44.3
1975	32,044	− 2.4	1,801	−21.3	5.6	12.1	8.2	48.3
1974*	32,837	+23.9	2,287	+58.7	7.0	16.8	11.1	47.4
1973	26,503	+13.6	1,441	+53.1	5.4	12.5	8.7	44.0
1972	23,324	+ 4.9	941	+83.8	4.0	8.9	6.0	46.8
1971	22,224	+ 5.5	512	−28.8	2.3	4.8	3.2	49.2
1970	21,069	+ 2.2	719	−27.2	3.4	7.0	4.8	46.8
Average 1970-82		**+ 9.0%**		**+10.4%**	**4.9%**	**11.2%**	**7.6%**	**46.6%**
1969	20,607	+10.0	987	+11.0	4.8	9.7	6.8	41.8
1968	18,738	+10.9	889	+11.7	4.7	9.6	6.6	45.1
1967*	16,900	− 0.7	796	−12.6	4.7	8.8	6.2	41.5
1966	17,016	+11.8	911	+21.0	5.4	10.5	7.7	35.6
1965*	15,217	+ 3.0	753	+ 0.1	4.9	9.2	7.1	30.0
1964	14,771	+ 5.1	754	+18.9	5.1	9.1	7.3	23.7
1963	14,050	+ 2.6	634	+ 0.9	4.5	8.0	6.4	24.9
1962	13,698	+ 9.4	628	+ 7.7	4.6	8.1	6.5	25.1
1961	12,525	+ 6.5	583	− 0.7	4.7	7.6	6.2	22.6
1960	11,764	− 0.5	587	− 5.2	5.0	8.4	6.8	23.3
Average 1960-69		**+ 5.8%**		**+ 5.3%**	**4.8%**	**8.9%**	**6.8%**	**31.4%**

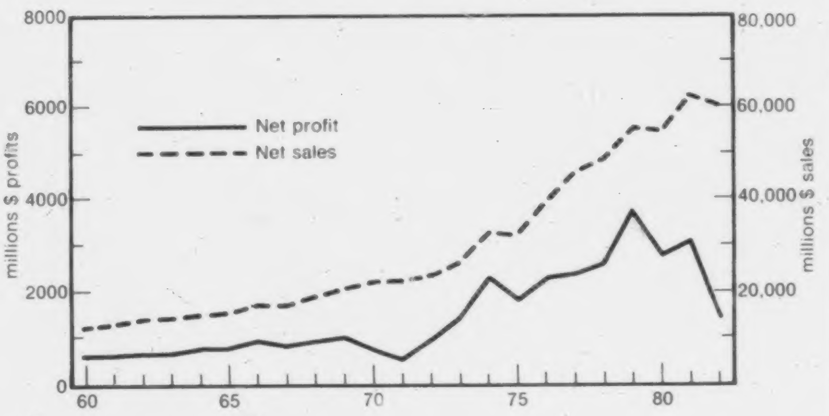
* Revised—change in corporations included in series so prior year data not exactly comparable.
Definitions: Profit margins = after-tax net profit to net sales. Return on net worth = after tax net profit to net worth. Return on total capital = after-tax profit to net worth + long-term debt. Debt to net worth = long-term debt to net worth.

Source: Based on Federal Trade Commission quarterly data compiled by American Paper Institute.

return on net worth exceeded the average in the 1974-75 tight-market period. Return on net worth reached a peak of 16.8% in 1974, hovered in the 12% to 13% range from 1975 to 1978, and then hit 16.0% in 1979, according to Federal Trade Commission data. Return on net worth then declined to the 12% level in 1980 and 1981 before plummeting to 5.5% in 1982. Since then, industry return on net worth has been rising on the strength of better profit margins, reaching 8.5% in 1983 and 9.1% in the first quarter of 1984.

Return on total capital (net worth plus long-term debt) has not kept up with return on net worth, reflecting the heavy debt loads built up by the industry. Long-term debt as a percentage of net worth rose from the low 20% range in the first half of the 1960s to an average of 47% in the 1970s. In 1982, debt to net worth rose to 49% when profits crumbled. Many companies did not scale back their capital spending programs quickly enough to make up the difference. Deterioration in this and other financial ratios caused downgrading of credit ratings for a number of major producers. Companies have moved to improve their liquidity in the current upturn, mainly through stock offerings and the sale of assets, but many major producers remain highly leveraged—and a few have increased their debt to finance large acquisitions. Capital spending plans are also back to record levels as programs deferred during the recession are brought back on track and producers prepare for the next round of capacity additions.

NET SALES AND PROFITS, 1960-1982



Source: Federal Trade Commission

CAPITAL SPENDING

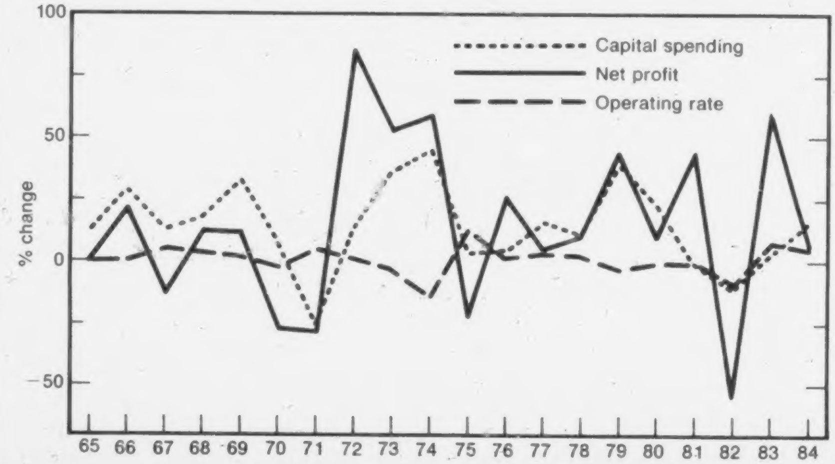
Encouraged by strong demand, high operating rates and greatly improved earnings, U.S. papermakers stepped up their capital spending plans to new highs in 1984. Paper companies planned to spend a record $7.13 billion in 1984 on new plant and equipment, up 15.4% from 1983 spending of $6.18 billion, according to a Commerce Dept. survey conducted in July and August 1984. Contributing to the surge in spending plans was the lower inflation rate, as well as attractive financial incentives such as the 1981 depreciation allowance, according to analysts. Another factor cited by observers was the strong dollar, which has made overseas competition tougher for U.S. producers, underscoring the need for modern, efficient operations.

Spending for new plant and equipment at U.S. paper mills reached a seasonally adjusted annual rate of $6.93 billion in the first quarter of 1984 and $7.05 billion in the second, the Dept. of Commerce reported. Spending was expected to increase to an annual rate of $7.25 billion in the third quarter and $7.28 billion in the fourth, easily surpassing the old mark. Industry expenditures peaked in 1980 at $6.80 billion before dropping during the recession to a low of $5.97 billion in 1982.

In its annual spring survey of U.S. business's capital spending plans, McGraw-Hill Economics forecast U.S. paper industry outlays of $6.67 billion in 1984, up 7.9% from 1983. The industry's planned increase trailed the field among the nondurable industries surveyed by McGraw-Hill, but the difference is probably due to the higher level of spending maintained by papermakers in 1983, when other industries cut back, the report said.

Big outlays for major producers. Most major U.S. paper companies plan to either increase capital spending or hold it at relatively high levels, according to recent annual reports. International Paper Co., for

CAPITAL SPENDING vs NET PROFIT AND OPERATING RATES



example, plans to increase spending 6% to $785 million as it completes its Georgetown, S.C., mill modernization and begins to restructure its Mobile, Ala., mill. Crown Zellerbach Corp. and Scott Paper Co. are in the middle of ambitious, multiyear programs to modernize and restructure their operations. And James River Corp., Westvaco Corp. and Hammermill Paper Co. have recently announced major spending increases. The biggest spenders are those companies building greenfield mills: Champion International Corp., Great Northern Nekoosa Corp. and Union Camp Corp. Union Camp, however, plans to reduce spending 21% to $325 million in 1984 after completing its new Eastover, S.C., white paper mill in fall 1984.

Companies with large forest products operations, including Georgia-Pacific Corp., Boise Cascade Corp. and Weyerhaeuser Co., have begun to revive their spending programs. One exception is Potlatch Corp., however, which will hold its spending reins relatively tight at $55 million and concentrate on short-range, high-return capital projects. "Lack of fiscal discipline at the federal level and the difficulties it will create for the recovery" are cited by chairman and CEO Richard B. Madden for the conservative company stance.

Historical trends. U.S. paper industry capital spending dropped by 26% in the 1971 recession, but it rose in each of the following 10 years, even through the severe 1974-75 downturn, when companies were making heavy outlays to achieve compliance with environmental regulations. In the 1972-75 period, between 30% and 38% of total primary industry capital spending went for air, water and solid waste control, according to the National Council of the Paper Industry for Air & Stream Improvement.

More recently, energy programs to reduce dependence on fossil fuels and improve efficiency have claimed a substantial percentage of industry capital. A *Pulp &*

1984 CAPITAL SPENDING PLANS OF MAJOR U.S. PAPER COMPANIES AT MIDYEAR

(millions of $)

	1984	1983	1981	% change 1984/83
Boise Cascade	$300	$160	$151	87.5%
Champion	179	202	214	−11.4
Crown Zellerbach	300	252	305	19.1
Federal Paper Board	27	31	66	−12.9
Fort Howard	130	92	64	40.8
Georgia-Pacific	600	258	260	132.6
GN Nekoosa	260	389	275	−33.2
Hammermill Paper	175	54	180	224.1
International Paper	785	738	469	6.3
Kimberly-Clark	350	363	291	−3.6
Mead	170	83	126	104.8
Pentair	45	20	22	125.0
Potlatch	55	54	54	1.5
St. Regis Paper	200	102	281	96.6
Stone Container	30	21	63	42.9
Union Camp	325	411	286	−20.9
Westvaco	300	184	169	65.0
Weyerhaeuser	450	312	548	44.2

Source: PULP & PAPER PROJECT REPORT

CAPITAL SPENDING BY U.S. PAPER AND ALLIED PRODUCTS ESTABLISHMENTS

(millions of $)

	Total (SIC 26)	Pulp mills	Paper mills	Paperboard mills	Converting plants		Building paper/board mills
					Paper	Containers & boxes	
1982	n.a.	n.a.	$1,869	n.a.	n.a.	n.a.	n.a.
1981	$4,656	$301	2,109	$974	$746	$449	$27
1980	5,128	250	1,897	1,539	775	628	40
1979	4,447	240	1,714	1,229	725	491	48
1978	3,736	195	1,424	1,000	604	496	19
1977	3,295	301	1,115	934	507	421	17
1976	3,010	375	1,044	844	394	335	12
1975	2,718	294	832	807	412	347	26
1974	2,214	136	723	637	315	342	63
1973	1,530	119	508	344	304	227	26
1972	1,335	136	372	314	289	206	19
1971	1,197	135	374	228	262	180	18
1970	1,397	122	503	239	289	227	18

n.a. = Not available.

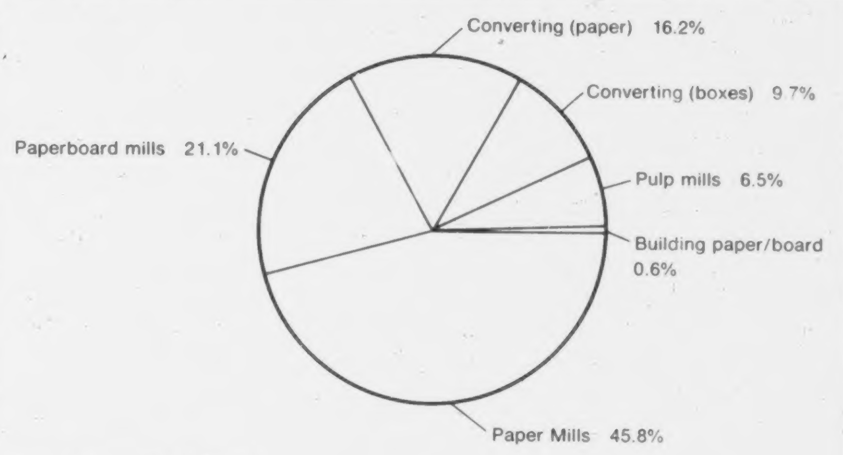
Source: Bureau of the Census.

Paper Project Report roundup in late 1981 counted 35 new power boilers and 19 new recovery boilers either being constructed or under consideration at U.S. mills. That number held steady in 1982, although several installations were deferred, before dropping in 1983 because of the recession. Since then the number of new boiler projects has returned to prerecession levels. Energy efficiency in 1983 rose 2.3% over 1982 and was up 38.1% compared to 1972, American Paper Institute figures show.

Another factor in the 14%/year rise in industry capital spending during the 1970s was rapid inflation in construction and capital goods costs. The following comparisons, though inexact, show how the costs of building new greenfield mills in several key grades have escalated. In 1971, Weyerhaeuser built a new 1,600-tpd containerboard mill at Valliant, Okla., for about $100 million—or about $62,500/daily ton. Ten years later, International Paper's 2,070-tpd Mansfield, La., mill was completed in 1981 for about $600 million—or about $290,000/daily ton.

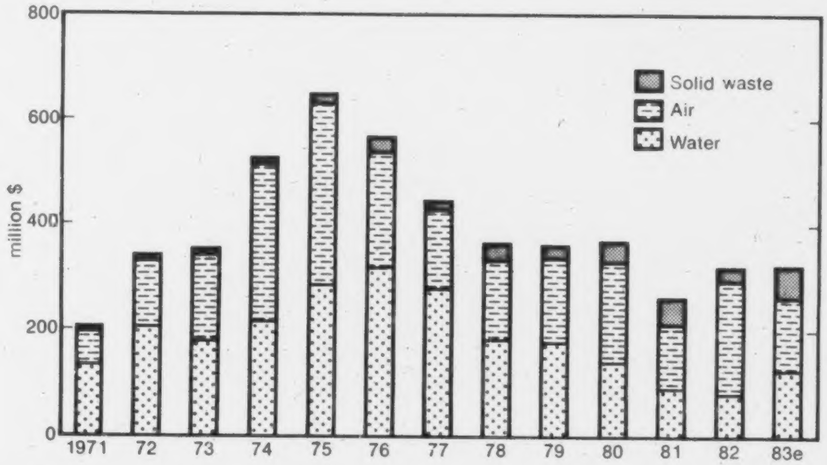
Weyerhaeuser completed a 600-tpd kraft market

1981 PAPER AND ALLIED PRODUCTS CAPITAL SPENDING



Source: Bureau of the Census.

CAPITAL SPENDING FOR POLLUTION ABATEMENT



Source: National Council for Air and Stream Improvement.

pulp mill at New Bern, N.C., in 1970 for $50 million—or about $83,000/daily ton. Great Northern Nekoosa's $560-million, 1,030-tpd greenfield Leaf River market pulp mill, started up in September 1984, will have an average cost of roughly $544,000/daily ton. Also scheduled for 1984 startup, Union Camp's integrated 600-tpd uncoated free-sheet mill at Eastover, S.C., will cost $530 million, or about $883,000/daily ton. In contrast, Champion International built a $100-million, 500-tpd bleached kraft pulp and paper mill at Courtland, Ala., in 1971 for $200,000/daily ton.

By categories. Companies responding to *P&P Project Report*'s latest capital spending survey covering 1983 to 1985, reported plans to spend $6.47 billion over the three-year period, a sharp drop of 21% from the 1982 survey and the lowest level since 1979. Of this total, 26% was earmarked for fiber and pulping projects, 11% was for paper machine modifications, 5% for new paper machines, 27% for energy projects, 21% for miscellaneous improvements, and 10% for environmental spending. The survey showed an emerging emphasis on incremental expansion through rebuilds as

U.S. PAPER INDUSTRY CAPITAL SPENDING ESTIMATES FOR 1984

(billions of $)

	1984e	1983	1982	% change 1984/83
Commerce Dept. (Apr./May)[1]				
Paper & allied	$7.13	$6.18	$5.97	15.4%
All manufacturing	130.39	111.53	119.68	16.9
McGraw-Hill (Apr./May)				
Paper & pulp	6.67	6.18	5.97	7.9
All manufacturing	141.79	111.53	119.68	27.1

e = Estimate.

Based on surveys conducted April/May 1984 by McGraw-Hill and July/August by the Commerce Dept.

U.S. PAPER AND ALLIED PRODUCTS COMPANIES CAPITAL SPENDING RELATED TO PROFITABILITY AND CAPACITY UTILIZATION

(millions of $)

	Capital spending[1]	% change	Net profit after taxes[2]	% change	Operating[3] rate
1984e	$7,170	+16.0%	$2,516	+7.7%	91.7%
1983	6,180	+3.5	2,337	+60.1	87.3
1982	5,970	−11.2	1,460	−52.9	80.9
1981	6,720	−1.2	3,100	+43.3	89.2
1980	6,800	+22.5	2,781	+9.8	90.1
1979	5,550	+39.1	3,723	+43.3	93.6
1978	3,990	+10.8	2,598	+9.8	92.1
1977	3,600	+15.8	2,367	+4.3	89.9
1976	3,110	+4.4	2,270	+26.0	89.0
1975	2,980	+3.1	1,801	−21.3	79.2
1974	2,890	+45.2	2,287	+58.7	92.7
1973	1,990	+36.3	1,441	+53.1	96.3
1972	1,460	+13.2	941	+83.8	95.8
1971	1,290	−25.9	512	−28.8	91.5
1970	1,740	+6.9	719	−27.2	90.4
1969	1,620	+32.8	987	+11.0	92.8
1968	1,220	+18.1	889	+11.7	91.4
1967	1,490	+12.9	796	−12.6	88.3
1966	1,320	+29.4	911	+21.0	93.0
1965	1,020	+12.1	753	+0.1	92.5

e = Estimate.

Source: 1. Bureau of Economic Analysis; 2. Federal Trade Commission; 3. American Paper Institute.

opposed to new paper machines. Planned outlays of 5% for new machines were down from 8% the previous year, while rebuilds were up to 11% from 6% last year.

In the latest survey, companies reported $4.2 billion in planned expenditures for capacity additions in the 1984-87 period. Of that total, 48% was earmarked for expanding paper capacity, 39% for pulp additions, and 13% for paperboard. In the pulping area, bleached kraft additions will take 92% of scheduled outlays over the three-year period, trailed by unbleached kraft at 5% and mechanical, thermomechanical, deinked and sulfite grades at about 1% each. About three-fourths of these bleached kraft outlays are for GNN's new Leaf River market pulp mill, started up in late 1984, and Champion International's greenfield market pulp mill at Quinnesec, Mich., scheduled for 1986 startup.

Among paper grades, printing and writing papers—mostly uncoated free sheet—continue to dominate spending, consuming almost 81% of the total. With four new machines scheduled, tissue additions account for 15% of planned outlays, followed by newsprint at 2% and kraft packaging and specialty papers at about 1% each. Two major projects completed in 1984 account for two-thirds of the uncoated free-sheet outlays reported in the survey: Union Camp's greenfield mill at Eastover, S.C., and Crown Zellerbach's new paper machine at Camas, Wash. Plans for several new machines have since been announced, however, which will keep spending for this grade high.

In a sharp departure from recent years, planned spending is relatively even among the paperboard grades: 40% of expansion funds are earmarked for linerboard, 35% for bleached board and 24% for recycled. Only 1% is destined for semichemical medium additions, however. With two greenfield mills scheduled for mid-decade startup, planned spending for linerboard additions has dwarfed other grades in recent years. Both of those mills have been postponed, however, while spending in the other grades got a big boost when plans were announced by Temple-Inland Inc. for a new recycled linerboard mill and by Westvaco for a new bleached board machine.

CAPACITY EXPANSION

Following a period of above-average growth in the late 1970s and early 1980s, U.S. paper and paperboard capacity expansion was expected to slow somewhat in the middle years of the decade due to the economic downturn of 1981-83. The recession forced papermakers to cut back capital expenditures, postpone a number of expansion projects, and permanently shut down older, less-efficient facilities. By depressing demand, the recession also exacerbated problems of overcapacity, following as it did on the heels of a massive capacity buildup in several grades.

According to the most recent American Paper Institute survey of pulp, paper and paperboard capacity, released in late 1984, total U.S. paper and paperboard capacity will rise during the 1985-87 period by an average of 1.6% a year, reaching 76.3 million tons by 1987. This compares with advances averaging 2.0% a year in the ten-year period from 1975 to 1984, and a 2.6%/year pace in the early 1980s. Pulp capacity (excluding pulp for construction paper and board production) will rise at an even slower 1.4% annual pace, climbing to 59.6 million tons in 1987 from 57.1 million tons in 1984.

In 1984, mills found ways to raise capacity by more than they had been expecting, leading API to increase its estimate of 1984 paper and paperboard capacity by 784,000 tons, to 72.7 million tons. Most of the revision came in the printing and writing grades, where mills worked very hard to squeeze extra output from their operations in order to take advantage of good business conditions. The bulk of the difference was in coated paper and uncoated free sheet, where capacity turned out to be 320,000 tons and 529,000 tons higher, respectively, than previously anticipated.

Because of the conservative methodology used in compiling the API survey statistics, current capacity figures usually tend to be overstated. Capacity that has been indefinitely shut down is not eliminated from the survey totals until at least a year has passed to insure that the equipment will not be reactivated. For this reason, 371,000 tons of shutdown capacity—or 21.0% of total shutdowns for the period—was not removed from the current survey figures. An additional 225,000 tons of shutdown capacity from the 1980-82 period remains in the survey totals. Because of the severity of the recession, capacity shutdowns totaled 5.24 million tons during the 1980-82 period, about double the amount from 1976 to 1979. Shutdowns in the 1983-87 survey period were expected to total 1.76 million tons, mostly in unbleached packaging papers and newsprint.

New machines will provide most of the new paper and paperboard capacity through 1987, accounting for 59% of planned additions, or 3.0 million tons, the API survey shows. Improvements to existing machines, after removing the capacity of machines taken offline, will provide the remaining 2.1 million tons of new capacity.

P&P Project Report's latest capital spending survey, covering 1984 to 1986, showed fiber and pulping projects accounting for 26% of planned outlays, while 13% was earmarked for paper machine modifications and 10% for new paper machines. Companies reported plans to spend $7.75 billion for capacity additions in the 1984-87 period.

PAPER LEADS THE FIELD

Capacity increases in paper are expected to exceed the gains in paperboard, with the highest growth rate occurring in the printing and writing paper grades at 3.6%/year, followed by tissue at 2.3%. In the paperboard grades, solid bleached board was expected to show the fastest growth at 2.0% a year.

Newsprint. Following a spectacular 40% buildup in newsprint capacity in the late 1970s and early 1980s, growth in this grade was expected to decline in the 1984-87 period, API's survey showed. Four new machines came online in 1980 and 1981, which along with incremental expansions raised capacity by 1.1 million tons to 5.3 million tons, a 26.2% increase. In contrast, a new machine started up in 1983 by Augusta Newsprint Co. was the only new installation expected in this grade between 1983 and 1987. API's latest survey

NEW MILLS AND MACHINES ANNOUNCED FOR THE U.S.

Company	Location	Project	Grade	Capacity (tpy)
For 1982 startup				
Mead	Escanaba, Mich	new machine	coated groundwood	200,000
Morris/Wis. Tissue	Menasha, Wis.	new machine	tissue	65,000
Portals	Hawkinsville, Ga.	new mill	cotton fiber	3,000
St. Regis Paper	Sartell, Minn	new machine	coated groundwood	170,000
Weyerhaeuser	Valliant, Okla.	new machine	kraft linerboard	200,000
Weyerhaeuser	Columbus, Miss.	new mill	coated groundwood	175,000
For 1983 startup				
Augusta Newsprint	Augusta, Ga.	new machine	newsprint	225,000
Champion Intl.	Courtland, Ala.	new machine	uncoated free sheet	150,000
MacMillan Bloedel	Pine Hill, Ala.	new machine	semichemical paperboard	210,000
Scott Paper	Skowhegan, Maine	new machine	coated free sheet	200,000
For 1984 startup				
Cascades	Rockingham, N.C.	new machine	tissue	17,000
Crown Zellerbach	Camas, Wash.	new machine	uncoated free sheet	160,000
Fort Howard Paper	Green Bay, Wis.	new machine	tissue	n.a.*
GNN/Leaf River	New Augusta, Miss.	new mill	bleached kraft pulp	355,000
Union Camp	Eastover, S.C.	new mill	uncoated free sheet	215,000
For 1985 startup				
Chesapeake	West Point, Va.	new machine	unbleached kraft liner	315,000*
Crown Zellerbach	S. Glens Falls, N.Y.	new machine	tissue	56,000
Georgia-Pacific	Crossett, Ark.	new machine	uncoated free sheet	105,000
Intl. Paper	Mobile, Ala.	conversion	uncoated free sheet	350,000
Laurel Hill Paper	Cordova, N.C.	new machine	tissue	18,000
Tagsons Papers	Mechanicville, N.Y.	new machine	tissue	14,000
Temple-Inland	Ontario, Calif.	new mill	recycled linerboard	175,000
For 1986 startup				
Bowater Carolina	Catawba, S.C.	new machine	coated groundwood	215,000
Champion Intl.	Quinnesec, Mich.	new mill	bleached kraft pulp	260,000
Fort Howard Paper	Muskogee, Okla.	new machine	tissue	n.a.
Georgia-Pacific	Port Hudson, La.	new machine	uncoated free sheet	228,000
James River	Naheola, Ala.	new machine	tissue	70,000
Little Rapids	Potsdam, N.Y.	new machine	tissue	18,000
Westvaco	Covington, Va.	new machine	bleached paperboard	250,000*
For 1987 startup				
Consol. Papers	Wis. Rapids, Wis.	new machine	coated groundwood	178,000
Champion Intl.	Quinnesec, Mich.	new machine	uncoated free sheet	200,000
GLFP/Ponderay	Usk, Wash.	new mill	newsprint	154,000
Hammermill	Selma, Ala.	new machine	uncoated free sheet	185,000
Proposed projects (no date)				
Augusta Kraft	Augusta, Ga.	new mill	kraft linerboard	263,000
Boise Cascade	Intl. Falls, Minn.	new machine	uncoated free sheet	n.a.
Boise Cascade	South Carolina	new mill	bleached kraft pulp/paper	284,000

Continued on next page

NEW MILLS AND MACHINES ANNOUNCED FOR THE U.S.

Company	Location	Project	Grade	Capacity (000 tpy)
Carolina Forest	Bennetsville, S.C.	new mill	newsprint	536,000
Champion Intl.	Halifax, N.C.	new mill	white paper	175,000
Champion Intl.	Jasper, Texas	new mill	kraft linerboard	350,000
Champion Intl.	unspecified	new machine	coated groundwood	n.a.
Fort Howard	Southwest	new mill	tissue	n.a.
Georgia Kraft	Elberton, Ga.	new mill	linerboard	455,000
Grenada Paper	Grenada, Miss.	new mill	newsprint	215,000
Independent Kraft	Tuscaloosa, Ala.	new mill	kraft linerboard	280,000
Kimberly-Clark	Southeast	new mill	bleached kraft pulp	n.a.
Longview Fibre	Longview, Wash.	new machine	lightweight kraft paper	n.a.
Midtec Paper	Kimberly, Wis.	new machine	coated free sheet	n.a.
Morris/Wis. Tissue	Menasha, Wis.	new machine	tissue	n.a.
Potlatch	Cloquet, Minn.	new machine	uncoated free sheet	n.a.
Potlatch	McGehee, Ark.	new machine	bleached paperboard	n.a.
Southeast Paper	Dublin, Ga.	new machine	recycled newsprint	160,000
Union Camp	Eastover, S.C.	new machine	coated free sheet	n.a.
Westvaco	Luke, Md.	new machine	coated free sheet	150,000
Weyerhaeuser	Columbus, Miss.	new machine	coated groundwood	175,000
Weyerhaeuser	Columbus, Miss.	new machine	uncoated free sheet	n.a.

n.a. — Not available.

* New capacity will replace at least some existing facilities so net increase in production will be smaller.

Source: American Paper Institute, PULP & PAPER Project Report.

U.S. PAPER AND PAPERBOARD MILLS AND MACHINES SHUT DOWN BETWEEN 1983-87 AND 1980-82

Grades	1983-87				1980-82			
			Annual capacity (000 tpy)				Annual capacity (000 tpy)	
	No. of machines	No. of complete mills	Removed from survey totals	Not removed from survey totals*	No. of machines	No. of complete mills	Removed from survey totals	Not removed from survey totals*
Total	**39**	**15**	**1,392**	**371**	**188**	**87**	**5,015**	**255**
Paper								
Newsprint	3	—	305	—	1	—	26	—
Printing/writing	5	—	58	14	27	5	517	134
Packaging/ind. conv.	5	—	372	—	22	8	341	—
Tissue	8	4	101	—	29	12	264	91
Paperboard								
Unbleached kraft	1	—	225	—	6	—	792	—
Bleached kraft	1	—	83	—	—	—	—	—
Semichemical	1	—	47	—	7	2	449	—
Recycled	8	7	119	197	25	12	967	—
Construction grades	7	4	82	160	71	48	1,659	

* Machines or mills indefinitely shut down but not removed from capacity totals since they could be reactivated.

Source: American Paper Institute.

showed capacity declining 55,000 tons by 1987 due to the absence of major expansions and to International Paper Co.'s decision to phase out over 300,000 tpy of newsprint capacity on one machine at its Mobile, Ala., mill and two machines at Pine Bluff, Ark. Too late to be included in the survey, however, was a new 154,000 tpy newsprint mill in Usk, Wash., to be completed in 1987 by a group led by Great Lakes Forest Products Ltd. Adding this total to API's results would indicate an expansion of about 100,000 in newsprint capacity through 1987.

Canadian newsprint mills, which supply over half of U.S. newsprint needs, are not expected to raise capacity by 1986, according to the Canadian Pulp & Paper Assn. Six newsprint machines were shut down in Canada in 1983, while another two units were converted to other grades, lowering capacity by 410,000 tpy.

Printing and writing paper. Net additions of printing and writing paper capacity will average 3.6% a year and total 2.2 million tons through 1987, easily surpassing the 2.0% annual growth rate forecast for all grades of paper and leading the field among all grades, according to the API survey. Uncoated free sheet will account for 1.2 million tons of the new capacity, up 11.7% from 1984, while coated paper capacity—both groundwood and free sheet—will jump 926,000 tons, an increase of 14.5%. Almost no growth is forecast for uncoated groundwood, bleached bristols, cotton fiber and thin paper grades.

Magazine industry growth and a tight publication paper market have stimulated capacity growth in coated groundwood papers, while business papers have benefited from the economic recovery and growth in the use of computers and copiers. Three new machines came online in 1982 at Mead Corp., St. Regis Corp. and Weyerhaeuser Co. mills, adding 545,000 tpy to coated groundwood capacity, and Bowater Carolina Co. will bring a 215,000-tpy machine online in 1986.

U.S. PULP AND PAPER INDUSTRY AVERAGE ANNUAL CAPACITY GROWTH, 1985-87 AND PRIOR TEN YEARS

(000 short tons)

	Additions 1975-84		Additions 1985-87	
Grades	10-year increase	Average annual growth	3-year increase	Average annual growth
Paper paper & paperboard	**13,222**	**2.0%**	**3,568**	**1.6%**
Total paper	**8,319**	**2.6**	**2,283**	**2.0**
Newsprint	2,215	1.7	(55)	(0.3)
Printing/writing	5,642	3.4	2,183	3.6
Packaging/indus. converting	(369)	(0.6)	(222)	(1.3)
Tissue	921	2.0	377	2.3
Total paperboard	**4,903**	**1.5**	**1,285**	**1.2**
Unbleached kraft	3,825	2.5	572	1.1
Solid bleached	266	0.7	252	2.0
Semichemical	789	2.2	174	1.1
Recycled	22	—	287	1.1
Total woodpulp	**10,002**	**1.9**	**2,460**	**1.4**
Dissolving & special alpha	(320)	(1.9)	—	—
Sulfite	(675)	(3.2)	(2)	—
Sulfate & soda*	8,678	2.3	2,186	1.7
Semichemical	336	0.8	85	0.6
Mechanical	1,982	4.0	191	1.0

*Includes screenings. ( ) = Decline.

Source: American Paper Institute.

Consolidated Papers Inc. has also announced a new coated groundwood machine, for 1987 startup, with capacity for 180,000 tpy. Additions in this grade will total 561,000 tpy between 1984 and 1987, a 15.2% increase, according to API. An additional 200,000 tpy of coated groundwood, too late for the API survey, will be added by International Paper at Pine Bluff, Ark., by late 1986, the company said.

No fewer than six new uncoated free-sheet machines with combined capacity of 1.1 million tpy are planned for the 1984-87 period, according to API. Two major projects completed in 1984, Union Camp Corp.'s greenfield mill at Eastover, S.C., and Crown Zellerbach's new machine at Camas, Wash., account for 375,000 tpy of that total. Georgia-Pacific Corp. will add 330,000 tpy to uncoated free-sheet capacity when it starts up machines at Crossett, Ark., in 1985, and Port Hudson, La., in 1986. Hammermill Paper Co. will install a new 185,000-tpy machine at Selma, Ala., in 1987.

In addition, IP plans to add substantially to uncoated free-sheet capacity through conversions. The company announced plans to convert its Mobile, Ala., mill to uncoated free-sheet production by 1985, with capacity of about 380,000 tpy. IP also recently converted a former linerboard machine to produce about 130,000 tpy of uncoated free sheet at its Georgetown, S.C., mill.

Kraft packaging paper. With the exception of some shutdown capacity, almost all of the 249,000-tpy reduction forecast for unbleached kraft packaging paper—to 3.7 million tons in 1987 from 4.0 million tons in 1983—is attributed to planned shifts of machine production to kraft linerboard or other grades. Of 50

U.S. PAPER & BOARD ANNUAL CAPACITY GROWTH, 1979-87

(000 short tons)

	1987e	1986e	1985e	1984	1983	1982	1981	1980	1979
TOTAL, ALL GRADES PAPER & BOARD	79,171	77,827	76,553	75,626	74,017	73,118	72,418	70,716	69,003
Total paper	39,134	38,100	37,297	36,851	35,675	34,665	33,639	32,659	31,179
Newsprint	5,792	5,765	5,758	5,847	5,774	5,654	5,229	4,836	4,199
Printing, writing & related	21,953	21,087	20,462	19,770	18,633	17,809	17,331	16,798	16,057
Uncoated groundwood	1,713	1,712	1,710	1,693	1,710	1,655	1,658	1,624	1,541
Coated groundwood	4,262	3,863	3,744	3,701	3,522	3,242	3,081	2,762	2,554
Coated free sheet	3,069	3,959	2,849	2,704	2,473	2,274	2,226	2,222	2,268
Uncoated free sheet	11,266	10,915	10,559	10,083	9,354	9,039	8,791	8,645	8,152
Cotton fiber	181	180	180	176	162	161	143	139	134
Thin papers	338	338	338	338	347	369	373	382	393
Solid bleached bristols	1,126	1,119	1,082	1,075	1,065	1,069	1,060	1,024	1,016
Packaging & industrial converting	5,769	5,754	5,755	5,991	6,078	6,076	5,947	6,072	6,053
Unbleached kraft	3,705	3,700	3,704	3,954	4,065	4,091	3,991	4,110	4,098
Bleached packaging & industrial converting	556	556	571	566	569	553	558	597	1,105[1]
Special packaging	565	563	554	551	550	527	533	498	—[1]
Special industrial	942	934	926	919	894	906	865	866	850
Tissue	5,620	5,494	5,322	5,243	5,190	5,125	5,062	4,954	4,870
Total paperboard	37,183	36,874	36,403	35,898	35,451	35,421	34,245	33,709	33,436
Unbleached kraft	18,362	18,214	18,027	17,790	17,511	17,402	16,685	15,967	15,546
Kraft linerboard	17,052	16,914	16,723	16,488	16,217	16,032	15,340	14,586	14,199
Solid bleached	4,439	4,354	4,321	4,187	4,129	4,123	4,015	4,180	4,268
Semichemical	5,393	5,350	5,299	5,219	5,119	5,207	4,952	4,946	4,864
Recycled	8,989	8,956	8,756	8,702	8,692	8,690	8,593	8,617	8,757
CONSTRUCTION PAPER/ BOARD & OTHER	2,854	2,854	2,853	2,877	2,891	3,032	4,264	4,347	4,419

1. Specialty packaging (mostly for food) combined with bleached packaging and industrial converting.
Capacity additions for 1987 include only presently known commitments and do not necessarily represent final expansion plans of the industry for that year.

Source: American Paper Institute.

unbleached kraft packaging machines in operation in 1983, 19 were making other grades, API reported, and several companies have announced programs to convert kraft paper capacity to other grades. Georgia-Pacific will convert its Crossett, Ark., mill from unbleached kraft packaging to white papers by 1985, while a similar program first announced for 1986 at Monticello, Miss., would convert brown paper output to linerboard production. International Paper's Mobile, Ala., conversion to white papers will also reduce unbleached paper capacity.

Tissue. At 2.3%/year, tissue had the second highest growth rate in the API survey, exceeding the ten-year average rate of 2.0%/year between 1975 and 1984. The startup of six new machines during the 1984-86 period and modernization projects already completed will increase tissue capacity 377,000 tons by 1987, to 5.6 million tons, according to API. Wisconsin Tissue Mills's Menasha, Wis., mill started up a 65,000-tpy tissue machine in 1982, but part of that increase was offset by the shutdown of an older machine. Other machines included in the survey were Tagsons Papers Inc.'s 14,000-tpy unit at Mechanicville, N.Y.; machines at Fort Howard Paper Co.'s Green Bay, Wis., and Muskogee, Okla., mills; a 16,000-tpy unit at Cascades Industries Inc.'s new Rockingham, N.C., mill; Crown Zellerbach's 56,000-tpy machine at South Glens Falls, N.Y.; and James River Corp.'s 70,000-tpy unit at Naheola, Ala.

SLOWER PAPERBOARD GROWTH

Paperboard capacity is expected to increase only 1.2%/year during the 1984-87 period, compared with a ten-year average rate of 1.5% a year.

Planned spending is relatively even among the paperboard grades for the first time in recent years: 40% of expansion funds are earmarked for linerboard, 35% for

REGIONAL DISTRIBUTION OF PAPER/BOARD AND TOTAL WOODPULP ANNUAL CAPACITY

(000 short tons)

	1987e	1983e	1980	1976
TOTAL PAPER/BOARD*				
New England	6,259	5,881	5,712	5,189
Mid-Atlantic	6,099	5,929	6,452	6,570
East North Central	12,476	11,664	11,253	11,235
West North Central	1,953	1,835	1,856	1,868
South Atlantic	18,929	17,717	16,945	15,693
East South Central	10,371	9,635	8,515	8,793
West South Central	11,782	10,719	10,267	9,591
Mountain & Pacific	11,302	10,637	9,716	9,643
Total U.S.	79,171	74,017	70,716	68,583
TOTAL WOODPULP*				
New England	3,335	3,298	3,253	3,213
Mid-Atlantic	1,472	1,473	1,465	1,645
East North Central	3,830	3,343	3,532	3,582
West North Central	893	850	899	1,112
South Atlantic	19,129	18,164	17,364	16,336
East South Central	11,271	10,212	9,251	8,910
West South Central	10,817	10,359	10,059	9,251
Mountain & Pacific	9,995	9,768	9,391	9,829
Total U.S.	60,868	57,590	55,214	53,880

Regions are as follows:
New England: Maine, N.H., Vt., Mass., Conn., R.I.;
Mid-Atlantic: N.Y., Pa., N.J.;
East North Central: Wis., Mich., Ill., Ind., Ohio;
West North Central: N. Dak., S. Dak., Minn., Neb., Iowa, Kans., Mo.;
South Atlantic: Del., Md., W.Va., Va., N.C., S.C., Ga., Fla.;
East South Central: Ky., Tenn., Miss., Ala.;
West South Central: Okla., Ark., Texas, La.;
Mountain/Pacific: Wash., Ore., Calif., Nev., Idaho, Mont., Wyo., Utah, Ariz., N. Mex.

* Includes construction paper and board and pulp to produce these grades.

Source: American Paper Institute annual capacity survey.

bleached board and 24% for recycled, according to *Project Report*. Only 1% is destined for semichemical medium additions, however.

Unbleached kraft linerboard. At 17.1 million tons, unbleached kraft linerboard will represent 46% of total board capacity by 1987, the survey reports. Linerboard capacity will rise by 564,000 tons between 1984 and 1987, a 3.4% increase. Besides rebuilds and improvements to existing units, this total includes swings of machine production from kraft paper. Chesapeake Corp. will bring online a new 315,000 tpy machine in late 1985, although the conversion of another Chesapeake linerboard machine to corrugating medium will reduce the new unit's contribution to total capacity. Even though only one new machine has been announced, capacity growth will probably be faster than projected due to conversion of kraft paper machines to linerboard and the installation of new high-pressure presses such as Beloit Corp.'s Extended Nip.

Semichemical paperboard. With no new machines scheduled, semichemical medium capacity is expected to grow just 1.1% a year during the survey period, rising 174,000 tons to 5.4 million tpy in 1987. This modest pace follows a 4.0%/year surge in the early 1980s, when medium showed the strongest growth of any grade of paperboard.

Solid bleached paperboard. Capacity in this grade is expected to rise 252,000 tons, or 6.0%, to 4.4 million tons by 1987. That total includes a new 250,000-tpy machine for 1986 startup at Westvaco Corp.'s Covington, Va., mill.

Recycled paperboard. No other industry segment has retired as much capacity as the producers of recycled paperboard. In the 1970-82 period, 94 machines with capacity for 3.0 million tons were shut down—amounting to 33.6% of total tonnage. Of that total, 2.7 million tons represent permanent shutdowns of dismantled facilities which have been removed from the API capacity totals.

Rebuilds of existing machines have offset these ca-

PAPER/PAPERBOARD MACHINES INDEFINITELY SHUT DOWN BETWEEN 1981–84

Company	Millsite	Shut[1]	000 tpy	Grade	Date
Allied Paper	Kalamazoo, Mich.	2 PMs	35	specialty paper	1/81
Manville Forest	West Monroe, La.	1 PM		unbl kraft paper	9/81
International Paper[2]	Bastrop, La.	mill (2)	214	semichemical medium	6/81 & 1/82
Boise Southern	Elizabeth, La.	mill (3)	106	unbl kraft paper	11/81
Nitec Paper[2]	Niagara Falls, N.Y.	mill (6)	80	coated paper	1/82
			40	tissue	4/82
James River	Bristol, Pa.	mill (3)	18	specialty paper	1/82
	Riegelsville, Pa.	mill	5	specialty paper	3/82
Scott Paper	Chester, Pa.	3 PMs	88	tissue	4/82
Crown Zellerbach	Moreau, N.Y.	mill	50	deinked pulp	4/82
Weyerhaeuser	Rothschild, Wis.	2 PMs	42	bl packaging paper	3/82
Boise Cascade	Salem, Ore.	mill (4)	91	unctd free-sheet	6/82
Scott Paper	Oconto Falls, Wis.	1 PM	26	tissue	6/82
Consolidated	Appleton, Wis.	mill	42	sulfite pulp	9/30
Manville Forest[2]	West Monroe, La.	1 PM	106	corrugating medium	6/82
		2 PMs	147	ctd kraft board	6/82
Clevepak	Piermont, N.Y.	mill (1)	60	recycled board	8/82
St. Regis	Coshocton, Ohio	mill (1)	50	corrugating medium	4/83
Publishers Paper	Oregon City, Ore.	mill	53	sulfite pulp	9/83
U.S. Paper Mills	Menasha, Wis.	1 PM	8	recycled paperboard	11/83
Georgia-Pacific	Bellingham, Wash.	1 PM	17	recycled paperboard	12/83
Publishers Paper	Oregon City, Ore.	1 PM	25	newsprint	2/84
International Paper	Pine Bluff, Ark.	2 PMs	184	newsprint	2/84
Sonoco Products	Richmond, Calif.	mill (1)	24	recycled paperboard	3/84
Crown Zellerbach	Los Angeles, Calif.	mill (2)	25	tissue	12/84
Total capacity shut down:		13 mills, 40 PMs	1,591	paper/paperboard	

[1] ( ) Following word "mill" indicates number of paper machines.

[2] Possibility that some or all of the capacity may eventually be reopened.

American Paper Institute Capacity Survey (1984) indicates 596,000 tpy of capacity that has been shut down but not removed from its survey totals because closures may not be permanent.

pacity reductions, however, keeping capacity even during the 1970s. API's survey showed capacity for recycled paperboard increasing 287,000 tons during the forecast period to 9.0 million tons by 1987, a 3.3% increase for the period. That figure includes Temple-Inland Inc.'s 175,000-tpy greenfield mill being built in Ontario, Calif., for 1985 startup. Another factor that may boost capacity figures is International Paper's purchase in late 1984 of Durham Mills Inc.'s 120,000-tpy mill at Riegelsville, Pa., which has been idle most of the time since 1980. And Chesapeake Corp. has announced plans to convert No. 1 kraft linerboard machine to allow production of 153,000 tpy of corrugating medium. Startup on that project is scheduled for late 1986.

WOODPULP GROWTH

Total woodpulp capacity (excluding pulp for construction paper and board) is expected to rise 1.4%/year between 1984 and 1987. Total capacity will grow 2.5 million tons, or 4.3%, to 59.6 million tons. This expansion rate trails the long-term growth rate for these pulps, which has averaged 1.9% annually since 1974.

Sulfate and soda pulp. The highest growth rate for the major woodpulps is forecast for bleached and semibleached sulfate pulps, which will rise by 2.2 million tons, or 10.2%, between 1984 and 1987. Both grades are used mostly in printing and writing papers and food packaging paper and board. Conversely, capacity for unbleached sulfate pulp—used to make containerboard and kraft packaging papers—will decline 0.3%, or 63,000 tpy, over the three-year period.

Market pulp. Market pulp capacity, after staying virtually flat in the 1982-84 period, is expected to rise 497,000 tons, or 6.6%, to 8.1 million tpy by 1987. All of the additional capacity will be in bleached sulfate pulp, which will grow 8.7% to 6.2 million tpy by 1987, the survey shows. Major projects include Great Northern Nekoosa Corp.'s 365,000-tpy Leaf River greenfield softwood and hardwood market pulp mill in New Augusta, Miss., started up in 1984, and Champion International Corp.'s 265,000-tpy greenfield hardwood pulp mill at Quinnesec, Mich., which is scheduled to begin operation in 1986. Some of the Quinnesec capacity will be diverted to white paper production in 1987, however, when Champion is scheduled to start up a 200,000-tpy uncoated free-sheet machine at the mill.

IP also recently started up a 300,000 tpy bleached softwood kraft line as part of the restructuring program at its Georgetown, S.C., mill. This will be partly offset by the shift of up to 100,000 tons of market pulp production at its Texarkana, Texas, mill to bleached board, however.

REGIONAL GROWTH TRENDS

The industry's concentration continues to be highest in the South, and this trend is expected to continue. In 1984, the South produced 52% of U.S. paper and board and 70% of woodpulp. Of the expansion plans reported to API for the 1984-87 period, 63% of paper and board additions and 75% of woodpulp additions will take place in the South.

The northeastern, central and western regions will all retreat from their current shares of total capacity for paper and paperboard, the API survey showed. While the West and Northeast will also lose woodpulp capacity, the Midwest will show a modest increase on completion of Champion's expansion at Quinnesec in 1987.

U.S. WOODPULP ANNUAL CAPACITY GROWTH, 1979-87

(000 short tons)

	1987e	1986e	1985e	1984	1983	1982	1981	1980	1979
Total woodpulp	**60,868**	**60,237**	**59,069**	**58,461**	**57,590**	**57,638**	**57,010**	**55,214**	**53,636**
Dissolving	1,504	1,504	1,504	1,504	1,525	1,606	1,590	1,590	1,551
Chemical paper grades	47,165	46,721	45,650	44,980	44,284	43,971	43,172	41,893	40,897
Sulfite paper grades	1,724	1,722	1,718	1,726	1,788	1,780	1,898	1,909	2,004
Sulfate & soda paper grades	45,441	44,999	43,932	43,255	42,495	42,191	41,274	39,983	38,893
Bl & semibl softwood	13,518	13,339	12,954	12,429	12,111	12,052	11,649	11,339	10,897
Bl & semibl hardwood	10,823	10,671	10,105	9,663	9,179	8,705	8,530	8,356	8,072
Unbleached	21,100	20,989	20,873	21,163	21,206	21,435	21,095	20,288	19,923
Semichemical	4,654	4,624	4,609	4,569	4,490	4,734	4,665	4,601	4,553
Mechanical	7,514	7,357	7,274	7,376	7,261	7,293	7,513	7,069	6,572
For paper and paperboard	6,245	6,088	6,005	6,054	5,814	5,780	5,482	5,070	4,573
For other paper and board	1,269	1,269	1,269	1,322	1,447	1,513	2,031	1,999	1,999
Screenings	31	31	31	31	31	34	70	61	63
Total market pulp	**8,066**	**8,172**	**7,994**	**7,569**	**7,414**	**7,079**	**6,987**	**6,081**	**6,334**

Source: American Paper Institute.

MERGERS AND ACQUISITIONS

Two years of deep recession followed by a record-setting boom have plunged the U.S. paper industry into what is probably the most intense period of merger and acquisition activity in its history. The recession forced many papermakers to reexamine their business strategies, and as a result many have moved to shed unprofitable or secondary operations in order to concentrate on their primary strengths. Also battered by the recession, a number of large, diversified companies have moved to divest their too-cyclical paper industry assets.

Thanks to the record strength of the economic recovery, would-be sellers have been having little trouble finding buyers. As a part of their repositioning efforts, companies selling assets in one area are often looking to expand in another. Others are taking advantage of the current upswing to rapidly expand their businesses. Very high operating rates have made expansion attractive, and current economic conditions make buying capacity far cheaper than building it.

Funding has also been a factor in the merger boom. Prices have recovered along with operating rates, boosting earnings and providing funds for acquisitions. Bank credit has also been readily available, even for such nontraditional deals as leveraged buyouts. And equity financing through new share offerings reached record levels in 1983, according to analysts.

Hostile takeovers. Complicating the picture has been a growing number of hostile takeover attempts from outside the industry. Stock prices have not risen since the recovery because of fears that the current boom won't last, making paper companies attractive takeover targets. A list of companies that analysts feel are vulnerable reads like a Who's Who of the U.S. paper industry. In addition, paper companies have proven easy to dismember, allowing raiders to finance their acquisitions by selling off independent operations.

British financier Sir James Goldsmith has been the most aggressive suitor of U.S. paper companies in recent years, making unsolicited offers for Diamond International Corp., Continental Group Inc. and St. Regis Corp. While only the first of these was successfully completed, both of the others lost their independence following Goldsmith's attention.

Sir James has sought out undervalued companies with assets that can be sold off easily as independent units, a strategy that turned out to be very profitable in the case of Diamond. Accumulating stock gradually after buying an initial 5.6% stake in Diamond in late 1979, Sir James completed the acquisition of Diamond in 1982. Total purchase price over the three-year period was about $658 million. Since then, Sir James has grossed roughly $850 million on the sale of Diamond's assets, with further sales to come. Assets remaining to be sold include Diamond's Northeast timberland, worth an estimated $125 million, and western wood products plants, worth about $75 million.

Goldsmith's next venture in the paper industry took the form of an unsolicited merger offer in 1984 for Continental Group Inc., an insurance, energy and packaging company and the largest U.S. producer of bleached paperboard. After purchasing a 1% stake in Continental for about $15 million, Goldsmith offered $50/share for the remainder of the company, or about $2.42 billion. While noncommittal in public, management was thought to be vehemently opposed to the offer, and soon afterward Continental agreed to a merger with a company owned 80% by Peter Kiewit Sons and 20% by financier David Murdock's Murdock Investment Corp. That deal was worth $58.50/share, or about $2.785 billion. Kiewit-Murdock announced later that about $1 billion of Continental assets would be sold to help finance the acquisition, and the company's big 1,075-tpd Augusta, Ga., bleached paperboard mill was seen as a prime candidate by many observers.

St. Regis targeted. The Most Grueling Merger of 1984 award certainly must go to St. Regis Corp., which between February and September fought off two unsolicited takeover attempts, paying greenmail in the first; sold a large chunk of its containerboard assets; agreed to buy an insurance company; and finally agreed to be acquired by Champion International Corp.

Following the same pattern as the Diamond takeover, an investor group led by Sir James bought an 8.6% stake in St. Regis in February. According to one participant, the group intended to increase its stake gradually and eventually take the company over. St. Regis bought back its shares from the group in March, however, paying a substantial premium over then-current prices—a defensive payoff known as "greenmail."

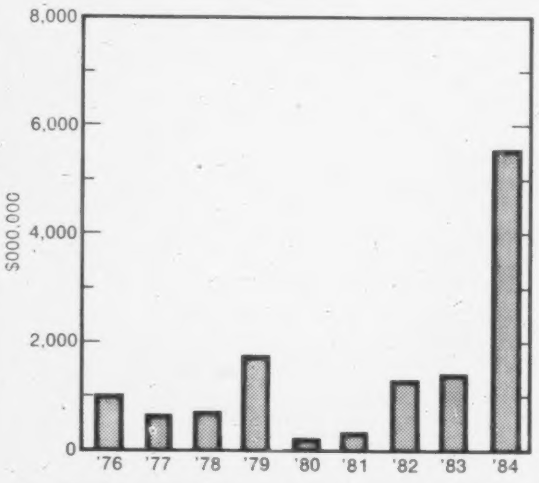
In May, St. Regis sold its Monticello, Miss., linerboard mill and related container plants and timberland to Georgia-Pacific Corp. for $342.5 million. While a takeover defense was probably not its primary reason—St. Regis had been unhappy with its containerboard operations to begin with—the sale did serve to make the company less attractive to unwanted suitors. G-P also became a friendly shareholder through the deal, agreeing to buy an 8.5% stake in St. Regis as part of the transaction.

The sale proceeds also improved St. Regis's ability to make acquisitions of its own, and in June the company did just that, agreeing to buy insurer Colonial Penn Group Inc. for $590 million. Like G-P, Colonial Penn became a friendly St. Regis holder—its stake amounted to about 3.5%—in the preliminary transaction.

Less than a month later, however, St. Regis was targeted for takeover by Australian publisher Rupert Murdoch, who purchased a 5.6% stake in the company in July. Murdoch made a $52/share offer for the company later that month, threatening an unfriendly—and less generous—tender offer if he was denied. Murdoch also demanded that the Colonial Penn acquisition be called off.

St. Regis's board rejected the Australian's offer, however, and blocked a takeover attempt by agreeing in early August to a friendly merger with Champion International in a transaction for stock and cash valued at $1.84 billion. The acquisition makes Champion the world's largest paper company. Champion, which has said it is interested primarily in St. Regis's core paper business, was expected to divest some of St. Regis's assets. By September, the company had also moved to limit its acquisition of Colonial Penn to a 22% share and to buy back the shares held by G-P.

SPENDING FOR MAJOR ACQUISITIONS 1976-84



Note: Spending totals include only acquisitions where purchase price was disclosed.

In another recent "white knight" merger, United States Gypsum Co. agreed to make a $38/share tender offer for Masonite Corp. worth at least $204 million. Masonite solicited the offer after General Felt Industries Inc., a carpeting and furniture manufacturer based in New Jersey, bought a 6.8% stake in the company and indicated interest in boosting its stake.

Takeover defenses. Not surprisingly, a number of companies have recently taken defensive measures to discourage unwanted suitors. Some of these defenses make gathering support for a takeover more difficult through such means as concentrating shares in the hands of friendly holders, staggering directors' terms, and negotiating standstill agreements. Others concentrate on making a company too expensive—through the sale of assets that could be sold off by a buyer to finance a takeover, for example. A similar defense involves making a large acquisition to boost the company's purchase price, as St. Regis tried to do with Colonial Penn.

One novel approach recently adopted by Crown Zellerbach Corp. and Owens-Illinois Inc. gives special purchase rights to shareholders in the event of a hostile takeover attempt. If a takeover occurs, the rights allow shareholders to buy stock in the surviving company at a steep discount—the CZ rights bestow $200 worth of buying power on each common share, for example. CZ's stock sells for around $30/share. At both CZ and O-I, the rights remain dormant until someone either buys 20% of the company or offers to buy more than 30% without company approval. The O-I rights also allow shareholders to buy a newly authorized issue of preferred stock.

Along similar lines, Scott Paper Co. got help in its battle to fend off a takeover by Brascan Ltd. when Pennsylvania passed a law requiring anyone owning more than 30% of a company's stock to make a bid for the remaining shares. Brascan, a Toronto-based mining and financial services concern, now owns 20.5% of Scott. The company has said it wants to increase its stake to 50% as soon as possible, although it is prevented from exceeding a 25% share by a standstill agreement good through 1985.

Leaving the industry. In the past few years, several major diversified companies have decided to divest their paper industry assets and invest their money elsewhere. In 1980, Gulf + Western Industries sold its controlling interest in Brown Co. to James River Corp., which got most of Brown's pulp and paper operations and some timberland, and Pope & Talbot Inc., which purchased two recycled tissue mills in Wisconsin. G + W retained Brown's building products operations as well as some timberland. ITT Corp. in 1980 sold its two British Columbia pulp mills and related forest products operations to Western Forest Products Ltd., a consortium of three British Columbia companies, and then offered to sell its four U.S. dissolving and paper-grade pulp mills and 1.3 million acres of timberland in the South and Pacific Northwest for a reported $3 billion—but no buyers were found and the assets were withdrawn from the market. In mid-1984, however, ITT announced new plans to consolidate its businesses, and the forest products assets may be put back on the block.

In 1982, American Can Co. sold its Dixie/Northern tissue and bleached board operations, as well as some timberland, to James River. The following year, the company completed its pullout from the industry by selling its Marathon, Ont., pulp mill to James River and its 50% interest in a Halsey, Ore., pulp mill to Pope & Talbot.

The pace if not the scale of divestitures picked up as the recession waned in 1983 and investment opportunities blossomed. Several companies shed their paper industry assets in favor of less cyclical investments.

In May 1983, Time Inc. announced the spin-off of its Inland Container Corp. and Temple-Eastex Inc. units into a new company, Temple-Inland Inc., in order to increase investments in its video and publishing units. In June, Litton Industries Inc. moved to concentrate on its electronics businesses, selling the major part of its Paper, Printing & Forms Group to Technographics Inc. in a leveraged buyout deal worth about $70 million. Also in June, Clevepak Corp. sold its partition mill division and other packaging assets to Rock-Tenn Co. for about $40 million, in part to help finance its intended acquisition of industrial-products maker Interpace Corp. And in August, Phillips Petroleum Co. sold its H.P. Smith Paper Co. unit to James River for $34.5 million.

Such moves to take advantage of better paper industry conditions extended into 1984, when Sonat Inc. sold its 50% interest in Boise Southern Co. to partner Boise Cascade Corp. for about $217 million. Also in 1984, Britain's Bowater Corp. spun off its North American operations in a tax-free "demerger" that automatically created the largest U.S.-based newsprint producer, Bowater Inc. The North American and overseas operations were different enough that their performances would be maximized by separating them, Bowater said. Observers also noted that Bowater had been moving out of the newsprint industry in the U.K.

Repositioning businesses. Also hit hard by the past recession, companies inside the industry have moved to streamline their operations and rethink their business strategies. As a result, several major companies have moved to sell off older, less profitable mills and shed operations that no longer fit their plans. Funds generated by these sales have in turn been used by some to modernize and reposition other facilities.

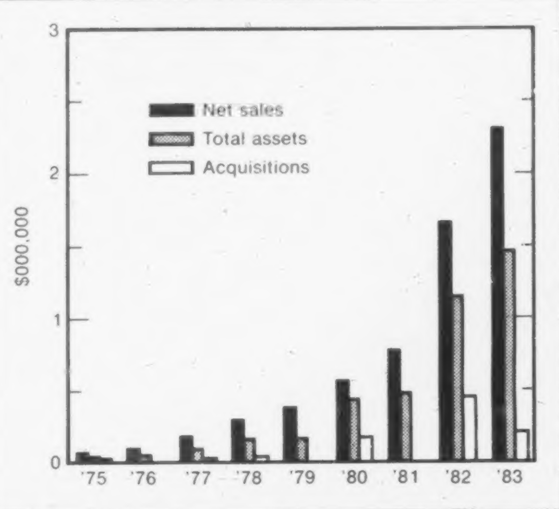
International Paper Co., for example, sold its Panama City, Fla., linerboard/market pulp mill to Southwest Forest Industries in 1979 and then in 1981 sold off all of its Canadian operations to Canadian Pacific Enterprises. IP is using the proceeds of these sales to modernize its southern U.S. mills and to increase white paper production.

Container Corp. of America and Packaging Corp. of America each shed several unwanted recycled boxboard plants recently, while Scott Paper Co. divested its furniture and foam units in order to concentrate on its paper operations. In 1984, Louisiana-Pacific Corp. tried to sell its Ketchikan Pulp Co. to employees for about $50 million under an employee stock ownership trust arrangement, the first deal of its kind in the paper industry. The sale fell through, however, when workers voted down pay cuts deemed necessary to secure financing.

Aggressive expansion. Some firms have expanded rapidly by buying assets from companies eager to leave the industry or to streamline their businesses. James River Corp., which began as a one-mill operation in 1969, is the best example of this strategy, achieving its current top-ten status largely through the purchase of assets divested by companies leaving the paper industry. After the Brown Co. deal with G + W in 1980, the purchase in 1982 of American Can's U.S. paper industry assets for $446 million more than doubled James River's size, further integrated the company into pulp production, and made it a major national producer of tissue and folding cartons.

In 1983, the company paid $170 million for Diamond International's pulp and papermaking assets,

JAMES RIVER, 1975-1983
NET SALES, TOTAL ASSETS,
ACQUISITIONS



MAJOR ACQUISITIONS INVOLVING U.S. PAPER INDUSTRY ASSETS

Acquiring company	Assets purchased	Estimated value (million $)	Year effective
Temple-Inland Inc.	Time's spin-off of Temple-Eastex and Inland Container	n.a.	1984
Stone Container Corp./Newark Group Inc.	Asset swap of one Newark recycled corrugating medium mill for two Stone boxboard mills	n.a.	1984
United States Gypsum Co.	Masonite Corp.	204+	1984
Stora Kopparberg Group	Newton Falls Paper Mill	n.a.	1984
Peter Kiewit Sons Inc./Murdock Invest.	Continental Group Inc.	2,785	1984
Little Rapids Corp.	Potsdam Paper Corp.	n.a.	1984
Georgia-Pacific Corp.	St. Regis's Monticello, Miss., linerboard mill, 16 related container plants, and timberlands	343	1984
Champion International Corp.	St. Regis Corp.	1,840	1984
Domtar Inc.	Upson Co.	n.a.	1984
Ashuelot Paper Co.	Putney Paper Co.	n.a.	1984
Boise Cascade Corp.	Sonat's 50% interest in Boise Southern	217	1984
Bowater Inc.	Bowater Corp.'s North American assets	123	1984
Appleton Papers Inc.	Glatfelter's West Carrollton, Ohio, mill	83	1984
Rock-Tenn Co.	Stroudsburg Paperboard Co.	n.a.	1984
Technographics Inc.	Litton Industries, including Fitchburg Paper	70	1983
Scott Paper Co.	50% not already owned of Italian affiliate Burgo Scott	28.2	1983
Republic Gypsum Co.	Two PCA recycled boxboard mills	n.a.	1983
Rock-Tenn Co.	Clevepak's partition mill division, recycled board mill, folding carton plant	40	1983
Stone Container Corp.	Major portion of Continental Forest's Brown System	510	1983
Simpson Paper Co.	Harding-Jones Paper Co.	n.a.	1983
Stroudsburg Paperboard Co.	Clay-coated board mill from PCA	n.a.	1983
Mosinee Paper Corp.	Sorg Paper Co.	17.8	1983
Packaging Corp. of America	Certain Diamond International molded pulp assets	n.a.	1983
Pope & Talbot Inc.	American Can's 50% interest in pulp mill	14	1983
Palmyra Paperboard Co.	Simplex chipboard mill	n.a.	1983
Pentair Inc.	Port Huron Paper Co.	15	1983
Jacksonville Paper Co.	St. Regis kraft paper mill	n.a.	1983
James River Corp.	Diamond's pulp and papermaking assets	170.8	1983
James River Corp.	H.P. Smith Paper from Phillips Petroleum	34.5	1983
Haindl Paper Co.	Crown Zellerbach's Port Townsend, Wash., unbleached kraft mill	n.a.	1983

Acquiring company	Assets purchased	Estimated value (million $)	Year effective
James River Corp.	American Can's Marathon, Ont., pulp mill	n.a.	1983
Fort Howard Paper Co.	Maryland Cup	500	1983
Boise Cascade Corp.	Saxon's Missisquoi specialty paperboard mill	n.a.	1983
St. Regis Corp.	Wausau's Hennepin Paper	n.a.	1982
Simpson Paper Co.	Crown Zellerbach's half interest in Fairhaven, Calif., kraft mill	21	1982
James River Corp.	American Can's U.S. tissue and bleached board mills	446	1982
Hammermill Paper Co.	EG&G's Miller Falls Paper Co.	n.a.	1982
Jefferson Smurfit Corp.	Diamond International's paperboard, converting and printing assets	80	1982
Cavenham Holdings (Goldsmith affiliate)	59.3% of Diamond International not already owned	500	1982
Fletcher Challenge Ltd.	CZ's 84% interest in CZ Canada Ltd.	242	1982
Weyerhaeuser Co.	most of Menasha Corp.'s West Coast assets	66	1981
Royal Packaging Industries Van Leer	Keyes Molded Pulp Container Group of Arcata	n.a.	1981
Jefferson Smurfit Corp.	remaining 19.4% of Alton Packaging not already owned	50	1981
Brascan Ltd.	20.5% interest in Scott Paper	220	1981
Pope & Talbot Inc.	Two Brown Co. tissue mills in Wisconsin	32	1980
James River Corp.	Most of Brown Co.'s pulp and paper operations, some timberland, from Gulf + Western	172	1980
Southwest Forest Industries	IP's Panama City, Fla., mill	220	1979
P.H. Glatfelter	Bergstrom Paper	24	1979
Johns-Manville	Olinkraft subsidiary of Olin Corp.	585	1979
Georgia-Pacific Corp.	Hudson Pulp & Paper	113	1979
International Paper Co.	Bodcaw Co., including Pineville Kraft	805	1979
Time Inc.	Inland Container	280	1978
Louisiana-Pacific	Most Fibreboard Corp. assets	60	1978
Arcata National	Keyes Fibre	88	1978
B.A.T. Industries (of Britain)	Appleton Papers, div. of NCR	280	1978
St. Regis Corp.	Southland Paper Mills	245	1977
Champion International	Hoerner Waldorf	340	1977
British Columbia Forest Products	Blandin Paper	75	1977
Mobil	Container Corp. of America (remaining 46% of Marcor not already owned)	884	1976
Boise Cascade Corp.	Oxford Paper, div. of Ethyl Corp.	90	1976

adding to its white paper capacity and extending its tissue and towel business in the Northeast. Also in 1983, specialty papermaker H.P. Smith was bought from Phillips Petroleum for $34 million. In 1984, James River expanded its nonwovens business, forming a new division with the purchase of Arkon Corp.

Another company that has grown rapidly through acquisitions is Jefferson Smurfit Corp., which entered the U.S. industry in 1974 with an investment in package-maker Time Industries Inc., bought that company outright in 1977, and then bought Alton Packaging Corp. for $50 million over a three-year period from 1978 to 1981. Smurfit then participated in the dismemberment of Diamond International, purchasing that firm's paperboard, converting and printing assets for $80 million in 1982 and in the process adding about 50% to its production capacity. Smurfit acquired a 9% interest in Southwest Forest Industries in mid-1984 and then made an offer worth about $317 million for the remainder of the firm. That deal fell through, however, due to problems in financing the merger.

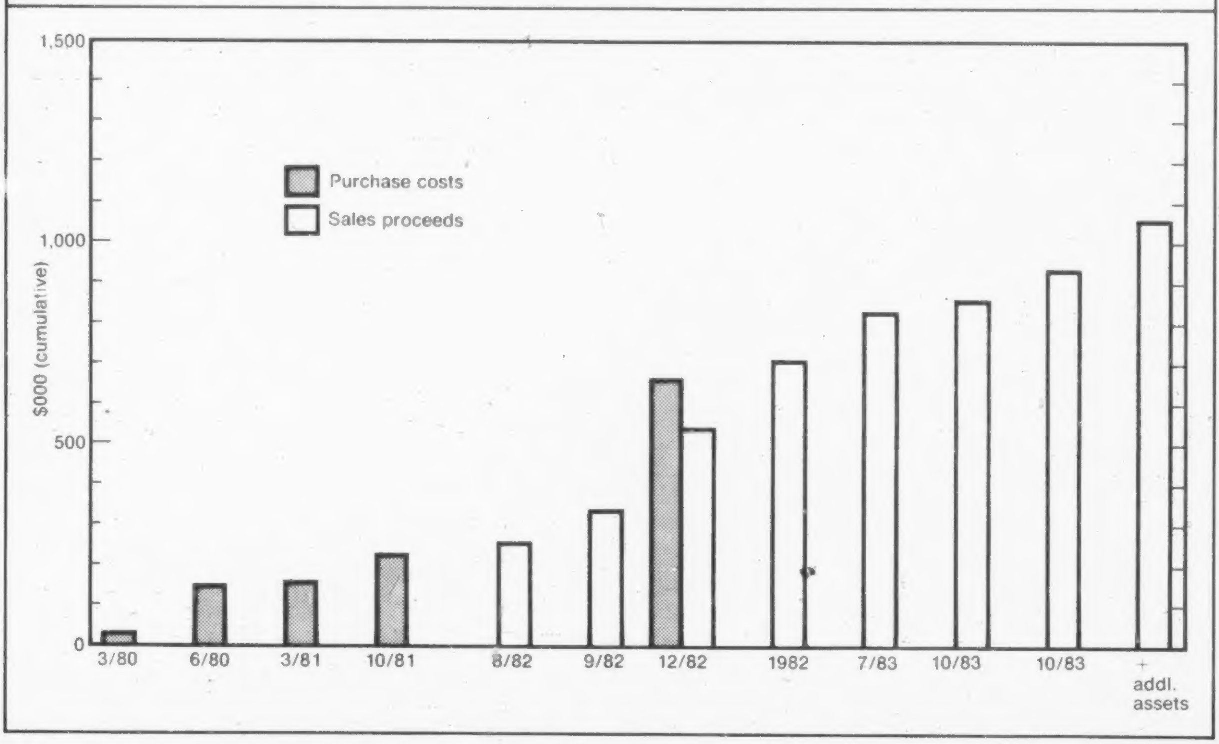
Stone Container Corp. more than doubled its capacity with the purchase of Continental Forest Industries' Brown System operations for $510 million in 1983, a move that makes Stone one of the largest producers of unbleached kraft grades. Continental sold those assets in order to concentrate on its specialty board businesses. Other companies building on assets divested for strategic reasons include Georgia-Pacific, Pope & Talbot, Simpson Paper Co., and Rock-Tenn.

Acquisition activity has not been limited to the larger companies. Mosinee Paper Corp. became one of the largest U.S. specialty papermakers with the purchase of Sorg Paper for $17.8 million in 1983. Sorg had turned down a $14-million offer from James River in 1981. Also in the specialty papers field, Pentair Inc. bought Port Huron Paper in 1983 for about $15 million.

While the majority of recent deals have involved papermaking assets, a few firms have looked outside the industry for expansion opportunities. One example is Fort Howard Paper Co., which acquired Maryland Cup Corp., a maker of disposable packaging products for the same commercial and industrial markets as served by Fort Howard, for $500 million in 1983.

Leveraged buyouts rise. Leveraged buyouts have been used successfully to finance a number of paper industry acquisitions in recent years. In a leveraged buyout, a small group of investors—often composed of company management—finances an acquisition through loans secured by the assets being purchased, and the loan is then repaid from funds generated by company operations or the sale of company assets.

DIAMOND INTERNATIONAL TAKEOVER
ACQUISITION COSTS vs PROCEEDS FROM SALE OF ASSETS



The majority of such deals involve divestitures of unwanted divisions, and most of the buyouts in this industry have fit this mold: American Forest Products was divested from Bendix Corp. in a $425-million leveraged buyout in 1981; Lily-Tulip Inc. from Owens-Illinois for $180 million, also in 1981; and Technographics Inc. from Litton Industries Inc. in 1983.

Less common but more widely publicized are buyouts involving whole public companies. In this group, Arcata Corp. was successfully taken private in 1981 for about $330 million. More recently, an attempt in April 1984 to take Southwest Forest Industries private for $312 million failed when the group, led by Southwest's president and CEO W.A. Franke, was unable to obtain financing—an increasingly common problem as lenders and investors began to turn a more critical eye on leveraged buyouts.

Foreign interests. A significant number of recent acquisitions in the U.S. paper industry have been made by foreign companies. To raise money for modernizing its core facilities in Washington, Oregon, and Louisiana, Crown Zellerbach Corp. in 1982 sold its CZ Canada Ltd. unit to New Zealand-based Fletcher Challenge Ltd. and its 50% interest in the Fairhaven, Calif., pulp mill to partner Simpson Paper Co. Then in 1983, CZ sold its Port Townsend, Wash., unbleached kraft mill to Haindl Papier GmbH of Fed. Rep. Germany.

Stora Kopparberg Group of Sweden made its first paper mill investment in the U.S. with the acquisition of Newton Falls Paper Mill Inc. from McGraw-Hill and American Broadcasting Co. in early 1984. Stora planned to boost coating capacity at the 400-tpd white papers mill, giving it the option of producing 100% coated paper. Also in 1984, Canada's Domtar Inc. purchased Upson Co., which operates a 170-tpd construction board mill in Lockport, N.Y. Upson had been operating under Chapter 11 of the bankruptcy code since mid-1980. Another Canadian firm, British Columbia Forest Products, itself partialy owned by Mead Corp. and Scott Paper, acquired Blandin Paper Co. in 1977.

Other moves by foreign companies to buy U.S. paper industry assets include the purchase of the Keyes Molded Pulp Group of Arcata by Royal Packaging Industries Van Leer of the Netherlands and the earlier acquisition of Appleton Papers Inc. from NCR Corp. by B.A.T. Industries of Britain. Under B.A.T. ownership, Appleton has expanded through the acquisition of a carbonless converting plant from Nashua Corp. and P.H. Glatfelter Co.'s 350-tpd recycled printing and writing paper mill in West Carrollton, Ohio.

Declining timberland values. Because of a glut on the market, one area where would-be sellers have had difficulty monetizing their assets is timberlands. Since 1981, timberland values have declined 30% in the West and 15% in the South, according to First Boston Corp.

Very few major sales have been completed lately, the most recent being Timber Realization Co.'s sale of former Masonite timberlands to Great Northern Nekoosa Corp. in 1983. Almost 300,000 additional acres of former Masonite land remain on the market, however. Similarly, an option on Diamond International's western timberlands was sold to Travelers Insurance in 1982, but the company's northeastern holdings remain in hand, awaiting better markets.

Several factors have contributed to the glut. Beset by problems of overcapacity and heavy inroads by Canadian producers, many hard-pressed wood products companies have put timberlands on the market to raise cash and consolidate their holdings. And with inflation moderating, timberlands are not the hedge against inflation they once were. Six to nine million acres of timberland are now estimated to be on the market—roughly 10% of U.S. forest industry holdings.

EMPLOYMENT

Production workers in pulp, paper and paperboard mills are the seventh-highest-paid among employees in 34 industries surveyed by Bureau of Labor Statistics.

Wages in the industry have also climbed faster than for the average worker in similar industries. According to the September 1983 BLS study, the straight-time earnings of mills averaged $10.22 an hour in July 1982 (56% higher than in a June 1977 BLS study), compared with a 46% (7.9% a year) rise in salaries and wages for all nondurable goods manufactured between June 1977 and June 1982.

Pulp, paper and paperboard mills are highly unionized. In the 1982 BLS report, labor-management agreements covered a majority of workers in mills employing 96% of the production work force. The United Paperworkers International Union was the predominant union except on the West Coast, where most of the workers were represented by the Assn. of Western Pulp & Paper Workers.

Virtually all workers were in establishments providing paid holidays; paid vacations; and at least part of the cost of life, sickness and accident, hospitalization, surgical, basic and major medical insurance; and retirement pension plans. Most of the life, health insurance and pension plans were paid for entirely by the employer, but that appeared to be changing in 1983-84 as new contracts were signed containing employee contributions toward these costs.

Employment in the pulp and paper industry declined between 1979 and 1982 due to layoffs caused by the recession and gradual industry modernization, but it started to increase again in 1983. Total employment in the paper and allied products industry as of June 1984 stood at 688,200, of which 519,700 were production workers, according to BLS data. This represented an increase of about 30,000 in total employment from a year earlier.

By industry segments, total employment in May 1984 broke down as follows: paper and pulp mills, 204,500; paper mills (except building paper), 178,600; paperboard mills, 58,900; miscellaneous paper converting (coating, envelopes, bags, etc.), 220,000; and paperboard converting (containers and boxes), 195,900.

HOURLY EARNINGS OF U.S. PAPER & ALLIED INDUSTRY PRODUCTION WORKERS

($)

	1984	1983	1982	1981
Paper and allied products	10.39[1]	10.24	8.60	9.66
Paper and pulp mills[3]	12.23	12.10	10.06	11.24
Paperboard mills	12.80[2]	12.58	10.23	11.72
Misc. converted paper products	8.99[2]	9.01	7.58	8.49
Paperboard containers/ boxes	8.88[2]	8.74	7.53	8.46
All U.S. manufacturing	9.12[2]	9.04	7.99	8.68

1. For June.
2. For May.
3. Include construction paper/board mills.

Source: Bureau of Labor Statistics.

TOTAL U.S. PAPER & ALLIED PRODUCTS INDUSTRY EMPLOYMENT BY SEGMENTS

(000)

	1984	1983	1982	1981
Paper and allied products	688.2[1]	674.5	653.0	687.8
Paper and pulp mills[3]	204.5[2]	203.4	196.6	203.2
Paperboard mills	58.9[2]	59.2	59.5	64.3
Misc. converted paper products	220.7[2]	217.2	208.4	219.7
Paperboard containers/boxes	195.9[2]	194.7	188.5	201.5

1. For June.
2. For May.
3. Include construction paper/board mills.

Source: Bureau of Labor Statistics.

The 364 mills within the scope of the BLS survey employed 150,200 production workers in July 1982. Employment of production workers was 12% below the total recorded in the summer of 1977. The southeastern states, with three-tenths of the production workers, and the Great Lakes area, with one-fourth, were the industry's largest regions.

Over 90% of the production workers were men. Women accounted for at least 10% of the work force in only two jobs, pulp testers and paper testers, and for about 5% of the power-truck drivers.

Wage rates. Wages rates in the U.S. pulp and paper industry rose at about a 9% annual rate in the late 1970s, but began to moderate in the 1980s. According to the American Paper Institute, average first-year pay increases for all employees in the pulp and paper industry in 1983 averaged 5.6% compared with 6.9% a year earlier and 9.6% in 1979.

Among six regions surveyed in the September 1983 BLS study, hourly earnings in July 1982 ranged from $12.43 in the Pacific states to $8.92 in the Middle Atlantic region. Workers in the Southeast, the largest region in terms of employment, averaged $10.53.

In addition to a moderating trend in wage increases, the industry's profitability has been bolstered by increases in output per employee-hour since the early 1980s. Previously there had been a declining trend.

The drop in productivity in 1982 was affected by the recession, as was the decline in pay increases, which reversed the pattern of the past decade in which wage rates substantially outpaced growth in output per employee-hour, resulting in a sharp escalation in unit labor costs for the industry. After remaining fairly stable in the 1950s and 1960s, unit labor costs during the 1970s jumped about 60%, reflecting a 131% increase in hourly earnings, while output per hour worked went up only 44%.

Wage levels at primary mills are higher than in the converting segments of the industry. Average hourly earnings at pulp, paper and paperboard mills were approaching $11/hour in May 1982, while wages at paper and container converting plants were well below that level.

Among the product grades studied by the BLS in 1982, pay averages were highest for workers in mills producing newsprint, groundwood, or containerboard, and lowest for workers in fine paper or boxboard mills.

On a regional basis, U.S. pulp and paper workers in the Pacific Coast section of the country earn the highest wages. Their representative base wage rates stood at $11.05/hour in 1983, while the comparative rate in the South was $8.56.

Pay levels were typically 10% to 30% above the national average in the Pacific states, slightly above average in the Southwest and Southeast, just below in the Great Lakes area, and 10% to 20% below in New England and the Middle Atlantic states, according to the 1982 BLS survey.

Bargaining in 1984. The rise in wage rates is expected

PRODUCTIVITY INDEXES FOR U.S. PAPER & ALLIED PRODUCTS

(output per employee hours; 1977 = 100)

	Production workers	All employees
PULP, PAPER & BOARD MILLS		
1984 (through July)*	124.3	122.5
1983	118.0	115.8
1982	108.4	106.3
1981	108.2	107.5
1980	108.1	106.6
1979	106.2	105.4
Average annual percent change		
1979-83	2.3%	2.0%
1978	103.7	103.2
1977	100.0	100.0
1976	95.0	95.0
1975	87.7	86.7
1974	90.5	91.5
1973	90.2	91.5
1970	75.8	77.5
1960	48.8	50.6
1954	37.9	40.4
Average annual percent change		
1947-83	4.0%	3.5%
1973-83	2.6	2.6
CORRUGATED & SOLID FIBER BOXES		
Average annual percent change		
1958-83	3.8%	3.6%
1973-83	3.2	2.8
FOLDING PAPERBOARD BOXES		
Average annual percent change		
1963-83	1.7%	1.6%
1973-83	0.3	0.2

* American Paper Institute data.

Source: Bureau of Labor Statistics.

AVERAGE FIRST-YEAR WAGE INCREASES IN U.S. PULP & PAPER INDUSTRY, 1981-83

Region	1983	1982	1981
South	5.9%	6.8%	8.2%
West	1.3	7.7	9.0
Midwest	5.1	6.6	8.5
New England	5.8	7.3	8.8
Northeast	5.2	6.7	9.0
All U.S.	5.6	6.9	8.7

Source: American Paper Institute.

to continue to abate in 1984 and perhaps level off in 1985 if inflation remains under control, which seemed likely late in 1984, with some industry observers expecting a slowdown in the economy and possibly a recession beginning sometime in 1985.

In addition to lower wage settlements than in previous years, companies were negotiating cuts in health care costs and improvements in productivity. Although there was some resistance to these terms—considered concessions by unions—companies generally succeeded in getting considerably lower payroll costs.

In 1984, a three-company bargaining unit on the West Coast implemented a contract, despite union rejection of the offer, which introduced an employee-deductible in the health care plan, among other items beneficial to the companies. Eventually the AWPPW ratified the contract, setting a precedent for negotiations in that area.

In 1984, an estimated 130 mills were set to bargain, up from 99 the previous year. The focus was on the Pacific Coast, where many of the workers at the 40 mills with contracts due to expire were represented by the AWPPW. In other regions of the country, 39 mills were scheduled to go to the bargaining table in the Midwest, 28 mill in New England, 18 in the Northeast, and 5 in the South.

Bargaining pattern. Contract negotiations in the U.S. pulp and paper industry tend to be fragmented, both within companies and within regions of the country, although some united efforts at negotiating do exist. On the West Coast, the AWPPW, representing 17,000 employees in the region, has sometimes bargained with large multi-company units.

The largest union of pulp and paper workers in the U.S. is the UPIU, which has 266,000 members—263,500 throughout the U.S. and 2,500 in Canada. In 1981, UPIU locals ratified contracts calling for an average wage increase of 8.6% compared with 7.8% in 1982, 6.23% in 1983, and 5.2% as of July 1984. An estimate of the division of the union's membership is as follows: 112,000 in the primary mills, 125,000 in converting operations, 8,000 in forestry, 20,000 in other sectors and 1,000 office workers.

Besides laying off hourly workers during the economic recession of 1981-83, companies curbed payroll costs by reducing salaried staff, freezing or cutting management salaries, and offering early retirement. To mention just a few such examples, Crown Zellerbach Corp. offered some of its employees early retirement and Consolidated-Bathurst Inc. cut 160 of its top and middle management salaries by 10% to 15%. When the economy began to recover in 1983, companies moderated cost-cutting policies but generally remained lean.

Bargaining outlook. Bargaining in 1985 is expected to be at the low ebb of the industry's three-year bargaining cycle, with the focus on the South. Companies will probably be in a better position to afford higher wage settlements than in the past few years because of increased profits in 1984. They are still

U.S. PAPER AND ALLIED PRODUCTS EMPLOYMENT AND EARNINGS

Year	All employees (000)	Production workers (000)	Average hourly earnings	Average weekly earnings
1984*	668.2	519.7	$10.39	$447
1983	674.5	505.8	10.24	449
1982	653.0	486.2	9.66	411
1981	687.8	518.0	8.60	365
1980	692.8	522.7	7.84	331
1979	706.8	535.6	7.13	304
1978	698.7	524.7	6.52	280
1977	691.6	518.2	5.96	256
1976	675.5	508.3	5.47	232
1975	642.0	479.7	5.01	208
1974	706.1	544.3	4.53	191
1973	704.6	543.1	4.20	180
1972	688.9	531.6	3.95	169
1971	681.9	521.8	3.67	155
1970	705.5	543.2	3.44	144
1965	639.1	497.7	2.65	114

* For June.

Source: Bureau of Labor Statistics

REPRESENTATIVE BASE WAGE RATES FOR REGIONS OF NORTH AMERICA 1970-86

Year	United States South	West	Canada Eastern	B.C.
1986	—	—	C$14.01	—
1985	—	—	13.34	C$14.09
1984e	$9.51	$11.22	12.83	13.48
1983	9.07	11.19	12.52	12.96
1982	8.56	11.05	11.38	12.96
1981	7.91	9.37	10.16	11.46
1980	7.28	8.53	9.23	9.96
1979	6.74	7.90	7.89	9.06
1978	6.13	7.25	7.46	8.16
1977	5.57	6.59	6.99	7.61
1976	5.04	5.96	6.47	6.89
1975	4.58	5.26	5.88	6.14
1974	4.15	4.78	4.57	5.10
1973	3.78	4.32	4.21	4.45
1972	3.48	4.02	3.85	4.09
1971	3.28	3.76	3.51	3.80
1970	3.09	3.45	3.25	3.50

e = Estimate.

Source: PULP & PAPER WEEK, American Paper Institute.

likely, though, to try to keep costs down, especially in the more competitive areas of the industry, such as recycled paperboard, newsprint and dissolving pulp.

Labor, on the other hand, will probably seek to get back some of the concessions it agreed to during the recession. As 1984 drew to a close, however, it was apparent that companies were not in agreement. In fact, mills continued to successfully reduce payroll costs with lower wage settlements and more economical health care programs. In addition, more agreements were being ratified with options to operate facilities on previously "restricted" (shutdown) holidays.

It appears as though management will continue to wield more strength than the unions in bargaining in the near term. Strikes no longer pose as much of a threat to companies because an increasing number of mills can be operated with supervisory personnel during walkouts. Also, unions themselves have lost some power since membership continues to decline due to fewer employees in the industry—a result of newer, more efficient mills coming on stream, shutdown of older mills, and upgrading of existing facilities.

U.S. PAPER WORKERS UNIONS

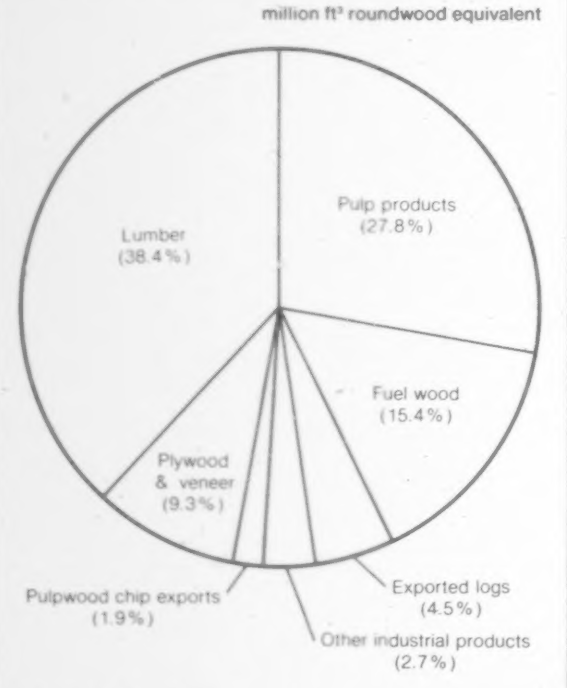
Union	Region represented	No. of members	No. in primary pulp and paper
United Paperworkers International Union	U.S.	266,000*	216,000
Association of Western Pulp & Paper Workers	U.S. west	17,000	17,000

*Includes approximately 50,000 employed in such areas as chemicals and hospitals.
International Assn. of Machinists & Aerospace Workers, International Brotherhood of Electrical Workers, and other major unions have representation at U.S. mills.

TIMBER RESOURCES & PULPWOOD COSTS

The attractiveness of timber ownership for U.S. paper companies has diminished somewhat in recent years due to high interest rates and the disinflationary economic environment. High interest rates have reduced the level of U.S. housing starts from their level of the 1970s and have contributed to a strong U.S. dollar which has caused a flood of Canadian lumber imports and reduced U.S. wood exports.

INDUSTRIAL ROUNDWOOD USE FOR PRODUCTION OF TIMBER PRODUCTS (1979)



Source: U.S. Forest Service.

Lower levels of U.S. lumber and plywood production have had the effect of reducing pressure on U.S. timber supply, while disinflation has caused timber ownership to lose some of its luster as a hedge against inflation. Companies have responded to these forces by putting large blocks of timber up for sale, although few buyers can be found.

These trends may again be reversed due to lower interest rates and a weaker U.S. dollar. Using population and economic trends, the U.S. Forest Service has projected that demand for lumber, plywood, pulpwood and other timber products will rise from about 14 billion ft^3 in 1979 to 22.7 billion ft^3 in 2030—roughly doubling in size.

Much of this increase is for pulp products, with pulpwood accounting for over 45% of total demand for roundwood in 2030, compared with about a third in 1976. In addition demand for fuelwood is also expected to increase due to rising oil and natural gas costs, adding competition for available wood supples.

Softwood timber supplies, in particular, are not expected to keep pace with this rising demand, resulting in scarcity and rising prices. However, the extent of the projected future supply/demand imbalance has probably lessened as a result of higher interests rates and a lower level of housing starts than anticipated by the Forest Service in its 1980 report, *An Analysis of the Timber Situation in the U.S., 1952-2030.*

U.S. TIMBER RESOURCE

The U.S. has a very large domestic timber resource, with about 737 million acres, 33% of the country's land area. Nearly two-thirds of this, or 488 million acres, is classified as commercial timberland, that is, land capable of producing at least 20 ft^3 of industrial wood per acre per year and not reserved for uses that are not compatible with timber production.

Farmers and other small private owners hold 283 million acres, some 58% of all commercial timberland. Another 69 million acres, or 14%, is owned by the

NET ANNUAL GROWTH AND REMOVALS OF GROWING STOCK ON COMMERCIAL TIMBERLAND IN THE U.S. BY SOFTWOODS AND HARDWOODS AND SECTION, 1952-76

(Million ft³)

Section	All species					Softwoods					Hardwoods			
	1952	1962	1970	1976		1952	1962	1970	1976		1952	1962	1970	1976
North:														
Net growth	3,985	4,741	5,288	5,792		993	1,234	1,362	1,600		2,992	3,507	3,926	4,192
Removals	2,114	2,078	2,472	2,659		635	540	596	705		1,479	1,538	1,876	1,954
Ratio of growth to removals	1.9	2.3	2.1	2.2		1.6	2.3	2.3	2.3		2.0	2.3	2.1	2.1
South:														
Net growth	6,448	7,813	9,576	10,705		3,625	4,680	5,605	6,158		2,823	3,133	3,971	4,547
Removals	5,675	5,525	6,502	6,572		3,112	2,811	3,769	4,472		2,563	2,714	2,733	2,100
Ratio of growth to removals	1.1	1.4	1.5	1.6		1.2	1.7	1.5	1.4		1.1	1.2	1.5	2.2
Rocky Mountain:														
Net growth	1,154	1,319	1,533	1,689		1,097	1,252	1,449	1,589		57	67	84	100
Removals	537	741	892	845		534	738	889	842		3	3	3	3
Ratio of growth to removals	2.1	1.8	1.7	2.0		2.1	1.7	1.6	1.9		19.0	22.3	28.0	33.3
Pacific Coast:														
Net growth	2,326	2,820	3,362	3,478		1,969	2,377	2,823	2,937		357	443	539	541
Removals	3,536	3,615	4,182	4,153		3,489	3,534	4,065	4,027		47	81	117	126
Ratio of growth to removals	.7	.8	.8	.8		.6	.8	.7	.7		7.6	5.5	4.6	4.3
Total, U.S.:														
Net growth	13,913	16,693	19,759	21,664		7,684	9,543	11,239	12,284		6,229	7,150	8,520	9,380
Removals	11,862	11,959	14,0948	14,229		7,770	7,623	9,319	10,046		4,092	4,336	4,729	4,183
Ratio of growth to removals	1.2	1.4	1.4	1.5	1.0	1.3	1.2	1.2	1.5	1.6	1.8	2.2		

Source: U.S. Forest Service, 1980.

forest products industry. The remaining area, some 136 million acres, 28% of the total, is public land. The largest part of this, 89 million acres, is national forest.

In its latest survey, the Forest Service estimated that the U.S. commercial timber inventory consisted of 711 billion ft³ of roundwood, of which 456 billion ft³ was softwood growing stock and 255 billion ft³ was hardwood. The largest portion of the softwood timber inventory in 1977, some 46% of all softwood growing stock, was in national forests, mostly old-growth stands in the western U.S., where there is a predominance of relatively large-size, high-quality trees. About 70% of the hardwood growing stock was on nonindustrial private ownerships, mainly in the East.

Growth/removal trends. The domestic timber resource situation has improved significantly over the last couple of decades, according to the Forest Service. For example, between 1952 and 1977 softwood growing stock inventories increased by 11% and hardwood by 43%. The increase in inventories has been almost entirely on the young stands in the North and South and chiefly on farmer and other private ownerships. Softwood inventories on the forest industry ownerships dropped substantially, the result of harvesting old growth stands.

The increases in inventories reflect net annual timber growth/removal balances. Since 1952, net annual growth of softwoods in the eastern section of the U.S. has been considerably higher than removals. In 1976, net annual growth of eastern softwood growing stock exceeded removals by 2.6 billion ft³, or 50%, the Forest Service has estimated.

For the western U.S., removals of softwood growing stock in 1976 exceeded net annual growth by 0.3 billion ft³, or 7%. Removals of softwood sawtimber were nearly 30 billion bd ft, over eight billion bd ft more than net annual growth. Most of the excess of removals over growth was on forest industry and national forest land.

Net annual growth of eastern hardwoods in 1976 substantially exceeded removals, particularly in the North. For the entire East, net annual growth of hardwood growing stock was 8.7 billion ft³—116% above removals—with the greatest part of this surplus growing stock on farmer and other private ownerships.

According to Forest Service data, softwood stumpage prices in the Pacific Northwest and South rose faster than the general rate of inflation between 1952 and 1976 (see table). Softwood prices in the northeastern and north central sections of the country have about matched the inflation rate, which has also been true for

NET VOLUME OF GROWING STOCK ON U.S. COMMERCIAL TIMBERLAND, 1977

	All species		Softwoods		Hardwoods	
	Billion ft³	Percent	Billion ft³	Percent	Billion ft³	Percent
North	173	24.4%	45	9.8%	129	50.4%
South	202	28.4	97	21.3	105	41.1
Rocky Mountain	100	14.0	95	20.8	5	1.9
Pacific Coast	236	33.2	219	48.1	17	6.6
United States	711	100.0	456	100.0	255	100.0

Source: U.S. Dept. of Agriculture, Forest Service, Forest Resource Report No. 23.

PROJECTED FUTURE U.S. DEMAND FOR TIMBER PRODUCTS, 1976-2030

Product	Standard unit of measure	Consumption	Projected demands—medium level	
		1976	2000	2030
Lumber	Billion bd ft	42.7	59.9	67.3
Plywood	Billion ft², 3/8 in. basis	20.7	30.1	34.1
Board (particleboard insulating board and hardboard	Billion ft², 3/8 in. basis	13.5	27.3	37.3
Pulpwood (U.S. mills)	Million cords	75.2	127.7	178.4
Other industrial products	Million ft³	379	800	900
Fuelwood (roundwood)	Million cords	8.1	18.7	30.7
Total roundwood, sawtimber	Billion ft³	13.3	22.7	28.3

Source: U.S. Forest Service, *An Analysis of the Timber Situation in the U.S., 1952-2030*, 1982.

hardwood in all regions.

Future timber supplies. Current growth/removal balances show that eastern softwood forests and domestic hardwood forests can support additional timber harvests, according to the Forest Service, which projects that softwood roundwood supplies will rise from 9.5 billion ft^3 in 1976 to 12.3 billion ft^3 in 2030, a 29% increase. The outlook is for increased softwood supplies nationally, but there are important differences among the major softwood timber producing regions.

Projected softwood sawtimber supplies in the Pacific Coast section are expected to drop substantially from 25.2 to 19.6 billion bd ft between 1976 and 2030, with much of the decline occurring by 1990. The major cause of this decline is the physical inability of the forest industry to maintain current cutting levels. The old-growth inventory in this ownership class is rapidly being depleted, and supplies from merchantable second-growth stands cannot offset the declines.

In contrast to the trends on the Pacific Coast, softwood sawtimber supplies in the South are projected to increase from 18.0 to 27.3 billion bd ft over the same period, mostly on nonindustrial private ownerships. Increases in the northern U.S. and Rocky Mountains are also expected, but on a much smaller scale.

Such changes in future timber supply for the Pacific Northwest and South will have a major impact on the forest products industry in the two regions. Declining timber supplies in the Pacific Northwest will result in closed mills and reduced employment levels in the forest products industry. In the South, the more favorable supply situation indicates future growth for the forest products industry, especially if steps are taken to regenerate softwood stands.

Hardwood roundwood supplies are projected to rise 2.7 times between 1976 and 2030, from 3.3 to 8.9 billion ft^3, with an increasing share in the South.

PRICES AND MARKETING

To bring about equilibrium in supply and demand, softwood stumpage prices will have to rise substantially in all regions, according to Forest Service projections. In the South, stumpage prices measured in constant 1967 dollars must rise at an average of 2.5%/year above the rate of inflation between 1976 and 2030. This is above the 1.8% rate projected for the Pacific Northwest Douglas fir region and the 1.9% rate for the north-central and eastern sections of the U.S.

The supply/demand outlook for hardwood is much more favorable than for softwood, and it appears supplies will be adequate to meet demand for the next two or three decades. As a result, there may not be much increase in hardwood stumpage prices (adjusted for inflation) in the years immediately ahead.

"The adverse impacts associated with economic scarcity and rising relative prices of stumpage and timber products are not inevitable," according to the Forest Service report. "There are large opportunities to increase and extend timber supplies."

INDEXES OF TREND LEVEL SOFTWOOD STUMPAGE PRICES IN THE U.S. BY REGIONS, 1952-76 WITH PROJECTIONS OF EQUILIBRIUM PRICES TO 2030[1],[2],[3]

(Indexes of prices/thousand bd ft international ¼-inch-log rule—1967 = 100)

Region	1952	1962	1970	1976	Projected indexes of equilibrium prices[3] 1990	2000	2010	2020	2030
Northeast	100.0	100.0	100.0	100.0	166.1	185.1	213.6	245.3	279.5
North Central	100.0	100.0	100.0	100.0	154.0	180.9	207.3	238.9	279.0
Southeast	57.8	83.3	111.6	138.9	229.6	280.0	358.0	434.6	526.8
South Central	57.8	83.3	111.6	138.9	230.6	281.6	358.5	434.3	524.7
Rocky Mountains	58.0	83.5	111.5	138.7	473.0	514.4	704.1	859.7	1045.0
Pacific Northwest:									
Douglas fir subregion (Western Washington and western Oregon)	43.8	75.9	118.0	164.2	275.0	228.2	287.4	355.8	430.3
Ponderosa pine subregion (Eastern Washington and eastern Oregon)	80.6	93.1	104.4	113.8	300.5	330.6	425.1	500.8	608.1
Pacific Southwest	52.9	80.9	113.6	146.5	300.8	334.7	416.3	490.2	579.9

1. Indexes of prices on a least squares regression line fitted to time series price data for the years 1950-76.
2. Prices are measured in constant (1967) dollars and are net of inflation or deflation. They measure prices changes relative to the general price level and most competing materials.
3. Indexes of the prices which would result from stumpage prices rising enough to maintain an equilibrium between projected timber demands and supplies.

Source: U.S. Forest Service, 1980.

U.S. EXPORTS AND VALUE OF WOODCHIPS

	Quantity		Value	Average value	
	short tons	metric tons	$	$/short ton	$/metric ton
1984[1]	2,255,458	2,046,106	146,875,000	$65.12	$71.78
1983	2,554,176	2,317,097	171,269,000	67.05	73.92
1982	2,860,133	2,594,655	231,140,000	80.81	89.08
1981	3,846,049	3,489,059	314,037,000	81.65	90.00
1980	4,478,234	4,062,564	377,899,701	84.39	93.02
1979	4,498,674	4,081,107	197,846,642	43.98	48.48
1978	3,617,574	3,281,791	156,679,856	43.32	47.74
1977	4,037,901	3,663,103	178,223,078	44.14	48.65
1976	3,946,817	3,580,473	153,001,887	38.77	42.73
1975	3,177,204	2,882,296	115,384,797	36.32	40.03
1974	3,865,780	3,506,958	113,929,564	29.47	32.49
1973	3,480,840	3,157,748	85,727,159	24.63	27.15
1972	2,524,415	2,290,099	57,070,248	22.61	24.92
1971	1,978,731	1,795,065	41,123,878	20.69	22.91
1970	2,418,161	2,193,707	36,634,138	15.15	16.70

[1] Annualized rate, half-year figures.

Source: Bureau of the Census.

U.S. PULPWOOD RECEIPTS AND CONSUMPTION

(000 standard cords, rough wood basis)

	1982	1981	1980	1979	1978	1977	1976	1974	1972	1970
Receipts, total	73,541	79,336	81,007	76,928	74,824	72,867	72,265	77,103	70,273	68,863
Domestic	72,524	78,283	80,320	76,124	73,970	72,094	71,443	76,262	69,254	67,723
Softwoods	n.a.	n.a.	59,582	56,741	54,803	54,680	53,689	55,531	51,793	53,356
Hardwoods	n.a.	n.a.	20,738	19,383	19,167	17,414	17,753	658	17,461	16,367
Imported	1,016	1,053	687	804	854	773	882	841	1,020	1,140
Softwoods	n.a.	n.a.	588	698	764	709	744	658	884	994
Hardwoods	n.a.	n.a.	99	106	90	65	78	183	135	146
Northeast	7,075	7,623	7,159	6,777	6,892	5,887	5,712	6,547	5,398	5,958
North Central	5,160	5,537	5,969	5,956	5,522	5,364	5,441	6,401	4,935	5,245
South Atlantic	23,580	25,146			25,353			23,414	22,334	21,835
South Central	24,725	26,521			25,678			24,953	23,113	20,493
West	13,001	14,509	16,496	14,477	13,483	14,937	14,766	15,986	14,492	15,367
Consumption, total	73,642	79,350	79,703	77,362	74,170	73,935	72,011	74,327	71,538	67,562
Northeast	6,714	7,043	7,318	6,748	6,501	5,949	5,877	6,149	5,878	5,699
North Central	5,394	5,865	5,715	5,728	5,492	5,473	5,442	5,678	5,222	5,034
South Atlantic	23,574	25,228	24,960	24,426	23,703	22,817	22,673	22,926	22,395	21,511
South Central	24,935	25,457	26,246	25,421	25,118	24,668	24,969	22,240	23,212	20,458
West	13,025	14,757	15,465	15,038	12,784	15,063	14,247	15,466	14,831	14,822

n.a. = Not available.

Source: Bureau of the Census, from Current Industrial Reports Series M26A.

In 1976, average net annual timber growth per acre on all ownerships was only about three-fifths of that attainable in fully stocked natural stands. With the use of genetically improved trees, fertilization, spacing control, and other intensive management measures, much greater growth can be achieved. There are also substantial opportunities for extending timber supply through more efficient harvesting and processing.

PULPWOOD MARKET BY REGION

About one-third of all timber currently harvested in the U.S. is used as pulpwood, with about 60% of this in the form of roundwood and the remainder in the form of chip residuals from wood-products manufacturing. The cost of delivered pulpwood, which includes a significant labor component, accounts for roughly 25% of paper industry manufacturing costs.

U.S. pulpwood consumption in 1983 totaled 85.4 million cords (128 ft^3), which was 8.1% greater than the 1982 level of 79.0 million cords. The 1982 level marked the end of a four-year consumption plateau which averaged 79.5 million cords/year, according to the American Pulpwood Assn. Through the first half of 1984, pulpwood consumption was up 4.2% from a year earlier, reflecting strong pulp production.

U.S. South. About 72% of the commercial timberland in the South is owned by private landowners; however, this land yields only about 60% of the timber harvested due primarily to poor forest-management techniques. As a result, paper companies have been trying to encourage better forest management practices among small landowners.

Roundwood pulpwood supplies over 60% of the region's pulp and paper fiber requirements, with the remaining 40% being from wood manufacturing residues, up from about 10% in 1960. Pulpwood consumption by the South Atlantic region in 1983 totaled 25.8 million cords, while consumption in the South Central part of the U.S. amounted to 29.2 million cords.

According to data collected by Timber Mart-South, softwood chip costs in the South jumped 16% from 1980 to 1981, but then slowed to 7% in 1982. Prices pushed upward by 10% during 1983 but slowed to an increase of 3% in the second quarter of 1984 compared with the year earlier.

Softwood roundwood costs rose only 1% in 1981, 5% in 1982 and 7% in 1983. Roundwood costs show some regional variation and are highest in Florida, Georgia, Louisiana and South Carolina, where there is a heavy concentration of pulp and paper mills. Lower pulpwood cost areas include Kentucky, North Carolina, Tennessee and Virginia, according to Timber-Mart South data.

Chip exports from the South to Europe started to develop about seven years ago as pulp mills in Scandinavia began to reach the limits of their domestic wood supplies. U.S. woodchip shipments to Scandinavia in

RECENT SOUTHERN U.S. PULPWOOD COST TRENDS[1]

	Roundwood[2] ($/cord)		Chips[3] ($/short ton)	
	Softwood	Hardwood	Softwood	Hardwood
1984				
1st qtr	$48.18	$32.48	$25.78	$17.77
2nd qtr	48.43	32.52	25.96	17.75
3rd qtr	48.51	32.72	26.03	17.81
% change 1984/83	+4.1%	+1.8%	+1.9%	+2.5%
1983				
1st qtr	43.20	31.72	24.24	16.83
2nd qtr	45.37	32.01	25.29	17.22
3rd qtr	46.61	32.13	25.54	17.38
4th qtr	47.72	32.43	25.68	17.64
% change 1983/82	+6.7%	+1.2%	+9.9%	+6.6%
1982				
1st qtr	41.47	31.24	22.10	16.08
2nd qtr	43.34	31.71	22.69	15.91
3rd qtr	43.16	31.87	23.06	16.30
4th qtr	43.28	31.90	23.83	16.52
% change 1982/81	+ 5.4%	+ 3.7%	+ 6.9%	+ 5.6%
1981				
1st qtr	40.06	30.71	20.73	15.10
2nd qtr	40.35	29.98	21.85	15.56
3rd qtr	40.90	30.56	21.71	15.67
4th qtr	41.04	30.62	21.85	14.62
Year	40.59	30.47	21.54	15.24
% change 1980/81	+ 2.2%	+ 9.9%	+ 14.8%	+ 5.2%
1980				
1st qtr	38.25	30.45	18.27	14.28
2nd qtr	39.72	30.90	18.42	14.49
3rd qtr	40.17	30.85	18.87	14.57
4th qtr	40.67	30.99	19.50	14.58
Year	39.70	30.80	18.77	14.48
% change 1980/79	+ 7.2%	+ 6.9%	+ 19.1%	+ 13.2%
1979				
1st qtr	35.93	27.86	14.82	12.67
2nd qtr	36.64	28.02	15.17	12.58
3rd qtr	37.41	29.33	16.29	12.90
4th qtr	38.17	30.01	16.74	13.02
Year	37.04	28.81	15.76	12.79

1. Average for 13 southern states.
2. Gate price f.o.b. yard; no gate or yard cost included.
3. Clean chips, f.o.b. mill or chipping plant.

Source: Timber Mart-South.

1981, mostly from the South, reached 739,000 short tons, but since then exports have dropped considerably to 185,265 short tons in 1983.

Northern U.S. Private landowners own most of the timberland and supply roughly 80% of the timber harvested—primarily hardwoods—in the Northeast and Great Lakes regions. Demand for forest products is fairly stable as timber production is not the primary goal of the region's landowners.

Pulpwood is supplied mostly in roundwood form, with growth far exceeding demand. Pulpwood consumption in the Northeast totaled 7.2 million cords, while consumption in the North Central states totaled 6.4 million cords in 1983, according to APA data. Despite the inroads being made on timber supply by firewood and biomass applications, as well as waferboard production, growth is still expected to outstrip demand through 1990.

U.S. Pacific Northwest. In the Pacific Northwest, public agencies own slightly over half of the forestland. Unlike other areas of the country, the bulk of pulp and paper fiber requirements—roughly 75%—is supplied from wood products manufacturing residuals. Pulpwood consumption in the region totaled 16.9 million cords in 1983. In 1983, 2.5 million short tons of chips were exported from the U.S. to Japan, primarily from the Pacific Northwest.

The heavy dependence of the Pacific Northwest industry on residuals contributed to a sharp rise in pulpwood costs in 1980 as the downturn in new home construction caused lumber and plywood plants in the region to take heavy downtime, cutting the flow of byproduct chips. Domestic and export demand for chips from the pulp and paper industry was still strong at this time, causing chip prices to skyrocket.

Pacific Northwest export prices for Douglas fir chips to Japanese mills jumped from about $55/bone-dry unit in the second half of 1979 to a peak of $131 in the second half of 1982. Purchased chip costs for domestic pulp and paper mills also followed this general trend, significantly raising manufacturing costs for the Pacific Northwest industry.

Chip export prices by the second half of 1983 had eased to $77/bdu, but upward pressure on prices was again beginning to develop in 1984 due to a weakening housing market. This time, however, pulp mills in the region were trying to increase their capability to process lower-quality logs to avert another chip shortage. Japanese chip purchasers have also diversified their sources of supply to prevent another "chip shock."

COMPANY HOLDINGS

Of the forest industry companies which own roughly 69 million acres of timberland in the U.S., International Paper Co. is the largest landowner on an acreage basis, with 7.1 million acres in the U.S., primarily in the South. Weyerhaeuser Co. is second with 6.0 million acres, and Georgia-Pacific Corp. third with 5.0 million acres (see table). Because of regional variations in timber stocking density, however, Weyerhaeuser leads in total timber inventory with 10.8 billion ft^3, followed by IP with 8.5 billion ft^3 and G-P with 6.0 billion ft^3, according to 1982 estimates by Morgan Stanley & Co.

Timberland holdings in the 1980s have become less attractive to many forest product companies. An

HISTORIC TRENDS IN U.S. PULPWOOD COSTS

	South				Wisconsin		West Coast
2nd Q.	Roundwood pine $/cord[1]	Roundwood hardwood $/cord[1]	Greenchip pine, clean $/ton[2]	Greenchip hardwood, clean $/ton[2]	Roundwood aspen $/cord[3]	Roundwood jack pine $/cord[3]	Douglas fir chip, export $/bdu[4]
1984	$48.43	$35.52	$25.96	$17.75	$32.00	$50.85	$ 78.00
1983	45.73	32.07	25.19	17.27	33.00	49.25	79.62
1982	42.86	31.68	22.93	16.20	35.00	54.75	100.75
1981	40.67	30.55	21.45	15.34	34.00	50.25	101.50
1980	40.16	30.64	18.50	14.38	32.65	43.50	113.25
1979	36.71	28.57	15.52	12.73	29.88	41.80	53.00
1978	34.00	26.60	14.30	12.10	27.38	34.46	n.a.
1977	32.20	25.50	13.80	11.60	25.25	35.88	n.a.
1976	31.20	25.50	13.50	11.20	24.75	30.82	n.a.

n.a. = Not available.

1. Average for 11 southern states, delivery to dealer yard (Timber Mart-South).
2. Average for 11 southern states, delivery to pulp mill (Timber Mart-South).
3. Median prices, delivery to mill (Wisconsin Forest Products Price Review).
4. F.A.S. to Japan.

Source: PULP & PAPER PRICEBOOK.

estimated six to nine million acres of timberlands were up for sale in mid-1984 (see table). And few buyers could be found for these parcels representing about 9% to 13% of the total U.S. forest industry timberland holdings of 68 million acres.

The large volume of timber for sale partly reflects a number of major mergers and acquisitions in the forest products industry. Companies are also trying to rationalize their timberholdings by selling off parcels that are not located strategically near wood or paper manufacturing operations. The low profitability of wood products manufacturing operations has made such efforts to "monetize" timber property particularly attractive. Timber ownership has also lost some of its luster as an inflation hedge in a disinflationary economic environment.

TIMBER HOLDINGS OF MAJOR U.S. PAPER COMPANIES

Company	Acreage (000 acres)	Inventories (billion ft³)
International Paper	7,100	8,563
Weyerhaeuser	6,000	10,814
Georgia-Pacific	5,000	6,010
St. Regis Paper	3,183	4,048
Boise Cascade	3,200	3,748
Champion International	3,027	3,541
Great Northern Nekoosa	2,900	2,871
Scott Paper	1,844	3,371
Union Camp	1,728	1,728
Crown Zellerbach	1,665	3,358

Source: Morgan Stanley & Co. Inc. Timber Survey, 1982.

LARGE U.S. TIMBER TRACTS FOR SALE

Company	Size (000 acres)	Location
Crown Zellerbach	650	Wash. Ore. La.
American Can	550	Ala. Miss. Mich. Wis.
Timber Realization	294	Miss. Calif.
Scott Paper	240	Wash.
International Paper	180	Maine
Kimberly-Clark	150	Ga. S.C.
ITT Rayonier	75	Wash. Fla.
Owens-Illinois	60	Fla. Ga. Va. Wis.

Source: *Wall Street Journal*.

U.S. COMMERCIAL FORESTLAND BY OWNERSHIP, 1981

(000 acres)

Region	Forest industry	Other private	National forests	Other public	All ownerships
South	35,754	134,937	10,955	6,788	188,433
Pacific Northwest	12,349	14,035	31,496	12,879	70,758
North	17,777	121,674	10,121	21,197	170,769
Rocky Mountain	2,096	12,502	36,436	6,732	57,765
All regions	67,976	283,149	89,007	47,595	487,726

Source: U.S. Forest Service.

ENERGY USE AND CONSERVATION

The pulp and paper industry is highly energy-intensive, ranking third after primary metals and chemicals in purchased energy consumption, and accounting for about 3% of total U.S. energy consumption.

When the paper industry's variable costs were ranked in proportion to the value of sales in 1983, fiber costs still clearly headed the list, followed by materials. Wages in manufacturing mills ranked third, with energy costs in fourth place.

It requires an average of 30 million Btus to manufacture a ton of pulp and paper: about 40% is required in the chipping and pulping operations, another 40% in drying and finishing, and the remaining 20% in bleaching, washing and refining stages.

The industry is unique in that the major portion of its total energy requirements come from self-generated and waste fuels, such as spent pulping liquors and woodwaste. At the same time, pulp and paper manufacturers have made significant progress in reducing their requirements for fossil fuels and other forms of purchased energy.

The industry continues to be the nation's leader in self-generated and cogenerated power. A recent Supreme Court decision will further encourage industry to increase, by 40% over the next five years, its 1983 cogeneration capacity of about 4,600 MW, according to Ronald Slinn, vice president of the Pulp, Materials & Technology Group of the American Paper Institute. The Court ruled that the Provisions of the Public Utility Regulatory Policies Act of 1978 are valid, and require a utility to purchase and distribute cogenerated power produced by nonutilities at no greater cost to consumers than if the utility had generated the power itself.

Between 1972 and 1983, the industry slashed by 37.3% its use of fossil fuels and purchased energy per ton of product, after adjusting for capacity utilization rates, fuel mix, and environmental requirements—all of which affect energy consumption—according to the American Paper Institute. Concurrently, the paper industry has increased its paper and paperboard output by almost 24%, and reduced its purchased energy requirements by over 29% and its consumption of oil by 55%.

Under the pressure of energy price increases, the industry expects to further decrease its reliance on purchased energy by using more self-generated and waste fuels and by improving process efficiencies.

Energy use pattern. Fuel use varies substantially from region to region. For example, mills in the New England/mid-Atlantic region are relatively more dependent on fuel oils, the North Central region on coal, while the Southeast and Northwest regions rely more on wood-based energy sources.

The proportion of the industry's total energy derived

U.S. PULP AND PAPER INDUSTRY'S PURCHASED ENERGY COSTS AS PERCENTAGE OF SHIPMENTS

(millions of $)

	Purchased energy costs*	Value of shipments	As percentage of shipments
1983e	$4,570	$36,000	12.7%
1982e	4,625	33,523	13.8
1981p	4,758	35,116	13.5
1980p	4,026	31,758	12.7
1979	3,268	27,991	11.7
1978	2,704	24,027	11.3
1977	2,550	22,302	11.4
1976	2,194	20,976	10.5
1975	1,876	17,822	10.5
1974	1,651	18,530	8.9
1973	933	13,714	6.8
1972	805	11,705	6.9

* Includes electric energy, fuel oil, coal, natural gas and other fossil fuels.

p = Preliminary.

e = Estlimate.

Source: American Paper Institute and Bureau of the Census.

from self-generated or waste fuels has grown from 40.5% in 1972 to 54.4% in 1983. This represents a savings equivalent to 187 million bbl of oil in 1983, or about 41 days of current oil imports.

Among the self-generated fuels, spent pulping liquors are the single largest source of energy, accounting for 38.1% of the industry's total energy use in 1983, up from 33.7% in 1972. Use of hogged fuel (woodwaste) has jumped during the period from 2.0% to 9.8% in 1983. Use of bark has risen slightly from 4.6% in 1972 to 5.5% in 1983.

Consumption of fossil fuels and other purchased energy showed a corresponding decline during the period, from 59.1% in 1972 to 45.6% in 1983. Residual and distillate fuel comprised 9.4% of total energy consumed in 1983, down from 22.3% 11 years earlier. Because natural gas has become more interruptible for industrial boiler use, the pulp and paper industry cut its reliance on this fuel from 21.5% of the 1972 total to 14.6% in 1983. Consumption of natural gas by the paper industry, which rose during 1981, has declined 27.4% since then.

Coal use dropped from 9.8% in 1972 to a low of 8.9% in 1978, reflecting the impact of more stringent air-quality standards. But coal use increased to 13.9% in 1983, and the rising trend is expected to continue and accelerate.

The rise in purchased electricity use from 4.4% of total energy in 1972 to 6.4% in 1983 may reflect the growth of mechanical pulping processes, which use more electricity, and of increased electrical requirements for environmental equipment. The electricity bill for the paper industry in 1983 was over $2 billion. As the largest cogenerator of electricity in the U.S., accounting for close to 50% of the total industrial cogeneration capacity today, or roughly 3,000 MW of power, the paper industry also sells some electrical energy. Some 37% of the paper industry's own electricity demand is cogenerated, representing an annual fuel savings of 22 million bbl of oil.

Progress is being made in energy conservation, although the U.S. paper industry's purchased energy costs rose sharply from 7.0% of value of shipments in 1972 to 13.5% in 1981, but decreased to 12.7% in 1983, according to Bureau of the Census data.

Rising energy costs have a varying impact on different segments of the paper industry. Newsprint made mainly from thermomechanical pulp requires a high amount of energy per ton of production, which is supplied by purchased electricity and fossil fuels (although some woodwaste may be burned). Unbleached kraft linerboard has lower total energy

U.S. PULP AND PAPER INDUSTRY ESTIMATED FUEL AND ENERGY USE, 1983 and 1972

Source	1983 Consumption (trillion Btus)	% of total	1972 Consumption (trillion Btus)	% of total
Purchased electricity	138	6.4%	93	4.4%
Purchased steam	17	0.8	23	1.1
Coal	300	13.9	225	10.6
Residual fuel oil	204	9.4	448	21.2
Distillate fuel oil	6	0.3	22	1.1
Liquid propane gas	2	0.1	3	0.1
Natural gas	315	14.6	441	20.9
Other purchased energy	3	0.1	2	0.1
Energy sold	(−22)	—	(−13)	—
Total purchased fossil fuel and energy	964	45.6	1,243	59.5
Hogged fuel, 50% moisture	212	9.8	42	2.0
Bark, 50% moisture	118	5.5	95	4.5
Spent liquor, solids	824	38.1	705	33.4
Self-generated hydroelectric	10	0.5	9	0.4
Other self-generated energy	12	0.5	3	0.2
Total self-generated and waste fuels	1,176	54.4	855	40.5
Total energy	2,140	100.0	2,098	100.0

Source: American Paper Institute.

requirements per ton than newsprint, and roughly half of this energy may come from burning black liquor. Recycled grades require considerably less total energy per ton to produce than virgin paper and paperboard, but must rely entirely on purchased fossil fuel and electricity. Purchased energy requirements for recycled newsprint are lower than for newsprint made from TMP, but are probably higher for recycled linerboard than for kraft linerboard. Thus, recycled paper and board production does not necessarily conserve energy—at least not from purchased fossil fuel and electricity.

Energy projects. To reduce the impact of rising oil and natural gas costs, the U.S. paper industry has been installing a large number of coal and woodwaste boilers, even though such solid fuel boilers may cost roughly twice as much as oil-burning units. By mid-1984, new power boilers had either been proposed or were under construction at 41 North American mills—up 28% from the 32 such projects in 1983, according to *Pulp & Paper Project Report* (Sept. 1984).

Ten new cogeneration plants have been planned by mid-1984, up from six in 1983. Several large hydroelectric projects have also been proposed, including one that will cost $100 million.

SELECT FUEL BTU VALUE, CONSUMPTION, COST

Fuel	Btu value/unit (million Btus)	1983 consumption (million units)	1983 cost ($ millions)
Spent liquors (solids) (tons)	12.2	68,849.0	—
Natural gas (million cubic feet)	1.03	309,309.6	1,500[1]
Coal (tons)	24.5	12,132.3	501[2]
Hogged fuel (tons)	8.36	25,361.3	—
Residual fuel oil	6.3	32,466.0	981[3]
Purchased electricity	3.4	40,530.1	2,007[4]

1. At wellhead.
2. At pithead.
3. At producer.
4. Average retail for industry.

Source: American Paper Institute.

CHEMICALS

A variety of chemicals are used in making pulp and paper, ranging from simple elements to complex compounds. Chemicals used in the paper industry can be divided into those used for pulping and bleaching and those required for papermaking, with annual consumption for each of the two major segments being around 5.7 million tons.

Pulping chemicals dissolve the lignin that holds cellulose fibers together in wood. Bleaching chemicals remove color and remaining lignin from the pulp to increase its brightness. Papermaking chemicals can generally be grouped into three divisions—fillers, sizers and coatings. Fillers are chemicals used in the papermaking process to fill the gaps between the fibers, while sizers are applied or incorporated to keep the paper from reabsorbing water and distorting its shape. Coatings are used to make paper smoother and easier to print on and also to improve its brightness.

Buoyed by the continued recovery of the U.S. pulp and paper industry in 1984, chemical selling prices firmed as demand continued to increase for most products. Although discounting continues in some cases, it is well below the level prevailing in 1983.

The industrial chemical producer price index rose during the first part of 1984. Projected price increases in 1985 for some of the major chemicals range from 5% to 15%, with hikes for the organic products at the low end of the range.

The strength in coated paper production in 1984 buoyed demand for such coating materials as titanium dioxide, kaolin clay, styrene-butadiene latex and starch. And higher woodpulp production increased demand for

CHEMICAL CONSUMPTION BY U.S. PULP & PAPER ESTABLISHMENTS IN 1977 AND 1982*

	Quantity (000 short tons)		Delivered cost (millions $)	
	1982	1977	1982	1977
Sulfur	275.7	308.6	$ 31.0	$ 18.4
Chlorine	1,335.1	1,268.5	165.0	148.9
Sodium hydroxide (caustic soda) (100% NaOH)	2,154.0	2026.7	433.1	255.9
Sodium carbonate (soda ash) (98% to 100%)	192.6	193.9	28.3	17.8
Sodium sulfate, incl. saltcake (100% Na_2SO_4	905.4	1,124.4	103.0	75.4
Sodium chlorate (100% $NaClO_3$)	309.5	n.a.	122.5	n.a.
Aluminum sulfate (17% Al_2O_3)	481.0	553.0	64.4	45.7
Titanium dioxide	154.8	129.7	214.8	119.8
Rosin sizing	134.4	134.3	118.1	71.5
Lime	1,172.9	1,247.4	75.9	54.9
Kaolin & ball clay	2,271.9	1,618.1	277.4	122.9
Starch	862.1	684.0	254.4	149.2

* For pulp, paper and paperboard mills only (SIC 2611, 2621, 2631)
n.a. — Not available

Source: Bureau of the Census.

such pulping and bleaching chemicals as chlorine and caustic soda, soda ash and sodium chlorate.

Chlorine and caustic soda are produced as coproducts, and this frequently leads to imbalances in one product or the other. During 1983, increased chlorine demand led to a surplus of caustic soda, resulting in heavy price discounting for it. However, in 1984, increased caustic demand resulted in significant inventory reduction, while chlorine demand weakened slightly in mid-year as housing starts faltered.

One major forest products company announced plans in 1984 to withdraw from significant involvement with chemical manufacturing. Georgia-Pacific Corp. reached agreement to spin-off most of its commodity chemical operations to a new company, formed by former G-P executives, to be called Georgia Gulf Corp. G-P, however, plans to retain chemical lines related to its core forest products businesses.

PULPING/BLEACHING CHEMICALS

Most of the **caustic soda** (sodium hydroxide) consumed by the pulp and paper industry is used by kraft and bleached sulfite mills, mainly for caustic extraction in the bleach plant. Kraft and semichemical mills also employ some caustic for sodium oxide makeup. Pulp mills in 1983 consumed an estimated 1.8 million tons of caustic soda, around 18% of all caustic soda produced. In 1984, mill consumption is predicted to be around two million tons, or about 17% of total production.

The price of caustic soda increased $35/ton in 1984, bringing the cost by the fourth quarter to around $150 to $185 f.o.b. (for 50% solution). Off-list prices may go up another 15% in early 1985.

Major U.S. chloralkali producers (caustic soda and chlorine) in descending order of capacity include Dow Chemical Co., PPG Industries Inc., Diamond Shamrock

ESTIMATED U.S. PAPER INDUSTRY CONSUMPTION OF SELECTED MAJOR CHEMICALS, 1984

Chemical	Paper industry consumption	% of total U.S. consumption	Applications in paper industry
Pulping/bleaching			
Caustic soda	1.8 million tons	17%	Used for caustic extraction in kraft bleached sulfite pulp mills
Chlorine	1.3 million tons	13	Main use is as bleaching agent in kraft, sulfite pulp mills
Sodium sulfate (saltcake)	495,000 tons	44	Main source of makeup sodium & sulfur in kraft pulp mills
Sulfur	95,000 tons	1	Mostly used in sulfite pulping, although some used directly in kraft pulping
Sodium chlorate	299,000 tons	84	Used in on-site chlorine dioxide generation for bleaching
Lime	976,500 tons	6	Used for causticizing sodium carbonate in kraft recovery process
Sodium hydrosulfite*	17,500 tons	32	Bleaching agent for mechanical, deinked pulps
Hydrogen peroxide	15,000 tons	15	Traditional bleaching agent for chemical, mechanical pulps; finding increased use in deinking newsprint
Pigments/filler/sizing			
Aluminum sulfate	656,000 tons	50	Mostly for precipitation of rosin size; also pitch control, water treatment
Kaolin clay	3.0 million tons	75	About 60% is used in filler applications; the remainder for coating
Titanium dioxide	344 million lb	24	Both anatase & rutile grades used as filler and in coatings
Starch	3.0 billion lb	65	Traditional binder for paper coating
Styrene-butadiene latex	235 million lb	35	Major use is as a coating binder
Polyvinyl alcohol	10.8 million lb	8	Mainly used for surface sizing printing/writing papers and also in coating
Calcium carbonate	154,000 tons	n.a.	Mostly used for coating but also as a filler

* Excludes on-site production via Borol process

Source: PULP & PAPER estimates

Chemical Co., Olin Corp., Occidental Chemical Co., Vulcan Materials, Georgia-Pacific and Pennwalt Corp.

The major end-use for **chlorine** in the pulp and paper industry is as a bleaching agent in both kraft and sulfite pulp mills. Small quantities of chlorine are also employed for onsite manufacture of calcium or sodium hypochlorite used to bleach chemical or mechanical pulp. In 1983, chlorine demand by the pulp and paper industry was an estimated 1.3 million tons, about 13% of the total demand for the chemical. In 1984, mill consumption is expected to be about 1.4 million tons.

A $15/ton price increase at the end of 1983 was followed by another $25/ton boost at the beginning of the second quarter of 1984, bringing the price to $175 to $200 f.o.b. works.

Chlorine use by pulp mills long-term is expected to decrease gradually under pressure of continued substitution by other bleaching chemicals.

Saltcake (sodium sulfate) is the principal source of makeup sodium and sulfur values in kraft pulp mills. Sodium sulfate is produced from both natural deposits or as a byproduct in the manufacture of rayon, sodium bichromate and hydrochloric acid. In 1983, kraft pulp mills consumed an estimated 498,000 tons of saltcake, about 47% of the total consumption. Mill usage in 1984 is expected to decrease slightly to about 495,000 tons.

Kraft mills require a low-cost alkali to causticize the sodium carbonate in green liquor. **Lime** is the cheapest alkali available (between 2¢ and 3¢/lb), and therefore is basic to the soda/lime route to free caustic. Kraft mills produce reburned lime on site. In 1983, pulp mills purchased about 980,000 tons of lime, some 6% of total consumption. In 1984, mill usage should increase 5% to 6% as total demand rises.

Sulfite pulp mills consume the bulk of the **sulfur** used by the pulp and paper industry. Some sulfur is also used directly in kraft pulp mills. Pulp mills used less than 1% of the total sulfur consumed in 1983, requiring about 97,000 metric tons. Major uses for sulfur are in fertilizer, petroleum refining, rubber, plastics and inorganic chemicals. Paper industry use is expected to rise to about 110,000 tons in 1984.

The major use of **sodium chlorate** is for onsite generation of chlorine dioxide. Sodium chlorate is derived from electrolysis of an acidified sodium chloride solution. Pulp mills in 1983 consumed an estimated 288,000 tons of sodium chlorate, 85% of the total demand. Mill demand should increase in 1984 to about 296,000 tons. Major producers include ERCO Industries Ltd., Georgia-Pacific, QueNord (a KemaNobel AB subsidiary), Kerr-McGee Chemical Corp., Occidental Chemicals, Olin and Pennwalt.

Hydrogen peroxide is traditionally used in the pulp and paper industry primarily as a bleaching agent for chemical and mechanical pulps. It is also employed in the deinking of recycled newsprint. In 1983, the pulp and paper industry used an estimated 15,500 tons, about 13.5% of total consumption. Increased use by kraft mills (in the second extraction stage) and continued growth in mechanical pulping should result in an average annual growth in industry demand of 9% to 10% over the next few years.

Sodium hydrosulfite is used as a bleaching agent for mechanical and deinked pulp. In 1983, the paper industry used an estimated 17,000 tons (excluding hydrosulfite produced *in situ* from the Borol process). This amounted to about 34% of total demand of 50,000 tons. There are only two sodium hydrosulfite producers

PRICE TRENDS FOR MAJOR CHEMICALS USED IN THE U.S. PULP & PAPER INDUSTRY

(f.o.b. producing plant)

	Unit	1983	1982	1981	1980	1979	1978
Calcium carbonate (precipitated)	$/ton	$170-180	$160-170	$95-160	$105-135	$98-123	$95-133
Caustic soda (50% solution)	$/ton	265-150	315-285	270-320	167-200	130-160	160-170
Chlorine	$/ton	145-180	145	145	145	135-150	135-145
Hydrogen peroxide (70% solution)	¢/lb	43	39.5	35.6-39.5	35.5-36.5	32.5	28
Kaolin clay (premium No. 1 coating)	$/ton	155	142	130	84	108	98
Lime	$/ton	—	57.80	51.63	41	41.16	36.75
Polyvinyl alcohol	¢/lb	105	105	100-105	86.5-91.5	77.5	69.5
Saltcake (sodium sulfate)	$/ton	91	79-86	68-79	60-68	47-52	35-45
Sodium chlorate	$/ton	420	420	375	345-375	355-345	—
Sodium hydrosulfite	¢/lb	60-63	60	55.60	43.5-55	41.5-43.5	39.4-41.5
Starch (unmodified)	$/100 lb	11.50-15.88	11.50-12.25	11.25-14	9.50-10.50	9-10	8
Styrene-butadiene latex	¢/lb	71-75	75	65-71	59	53	40-43
Sulfur	$/long ton	131-124	138.75-132.50	131.35-138.75	103.31-109	70.60	61.50
Titanium dioxide (anatase)	¢/lb	70	70	58-70	57	53	46

Source: PULP & PAPER

in the U.S., Olin and Virginia Chemicals Inc. Merchant sodium hydrosulfite consumption in 1984 may reach 17,500 tons. Hydrosulfite produced via the Borol process in 1984 is expected to hit the 8,000-ton level (100% basis), compared with 7,050 tons used by mills in 1983.

PAPERMAKING CHEMICALS

Kaolin clays are employed in a wide range of paper and board grades as both filler and coating pigment. Coating applications account for about 54% of industry usage. In 1983, an estimated 3.1 million tons of kaolin were used by the paper industry, about 75% of total kaolin consumption. Mill usage in 1984 is expected to increase to 3.3 million tons.

Starches are the workhorse binders for coating mills and are also used as surface sizers, internal additives and as adhesives for corrugated containers. In 1983, the paper industry used an estimated 2.8 billion lb, about 63% of total consumption. In 1984, use is expected to reach 2.9 billion lb.

Both rutile and anatase grades of **titanium dioxide** are used by fine paper and board mills as a filler and in coating. In 1983, mill demand for titanium dioxide was 197,000 tons or 23% of total consumption. Use in 1984 is expected to jump to 215,000 tons. Largest producers include E.I. du Pont de Nemours Inc., SCM Corp., American Cyanamid Co., Kerr-McGee Chemical Corp. and Gulf + Western Industries (in descending order).

About 85% of the **calcium carbonate** used in the paper industry is for coating, with the balance employed as filler. Precipitated grades are used in about 70% of the applications, but ground natural carbonate continues to find increased usage as finer grades are introduced. In 1983 the paper industry consumed an estimated 154,000 tons, with usage expected to rise to 166,000 tons in 1984.

The bulk (about 90%) of the **styrene-butadiene latex** (SBL) employed by the paper industry is used as coating binder; the remaining 10% is accounted for by paper saturation (masking tape and wallpaper). In 1983, an estimated 235 million lb of SBL were used by the paper industry, up about 7% from the previous year. This amounted to about 33.5% of total SBL production. In 1984, paper and board use is expected to rise to 248 million lb, with the paper industry's share of total production dropping to 31%. Major producers (in descending order of capacity) include Dow Chemical, Polysar Ltd., Reichhold Chemicals Inc., and Gen Corp. (formerly General Tire & Rubber Co.).

The paper industry uses **polyvinyl alcohol** (PVA) as a surface size for printing and writing papers and paperboard, and as a coating binder. In 1983, paper industry use of PVA was between 11 and 12 million lb, about 8% of the estimated total merchant demand of 140 million lb. In 1984, demand by paper and board mills should increase to between 12 and 13 million lb. Major producers include du Pont, Air Products & Chemicals Inc. and Monsanto Co.

TRANSPORTATION

U.S. pulp and paper producers move 60% to 70% of their shipments by rail, although use of trucks is growing. The 1980 deregulation of the transportation industry led to freight price increases, but the trend has been leveling off during 1983 and 1984.

Deregulation. Since the deregulation of the railroads in 1980 by the Staggers Rail Act, rail service in many parts of the country has been reduced through railroad mergers and abandonment of less profitable lines. The Motor Carrier Act of 1980, which deregulated the trucking industry, reduced profits for most carriers and resulted in a record number of bankruptcies.

The legislation allows shippers to negotiate on a one-on-one basis with carriers. This has resulted in improved competition and lower rates for paper industry and other shippers. In addition carriers and shippers are permitted to enter into contracts, which is probably the most significant change the legislation has produced. In obtaining new business, both railroads and truckers are using aggressively their new market and pricing flexibility.

Freight rates. U.S. railroad and other selected transportation freight rates rose sharply in the 1979-1981 period, reflecting higher energy costs and the transportation industry's freedom to increase rates following

U.S. RAILROAD FREIGHT PRICE INDEX

(1969 = 100)

	Pulp, paper & allied	% change from previous year
June 1984	345.1	4.3%
1983	331.6	1.3
1982	327.2	6.8
1981	306.5	15.9
1980	264.5	18.4
1979	223.4	13.3
1978	197.1	5.6
1977	186.5	5.9
1976	176.1	8.2
1975	162.7	13.4
1974	143.5	15.3
1973	124.5	0.3
1972	124.1	1.4
1970	122.4	12.3
1970	108.9	8.9

Source: Bureau of Labor Statistics

CARLOADING OF MAJOR U.S. RAILROADS, 1976-81

(000 cars loaded)

	1983	1982	1981	1980	1979	1978	1977	1976
Pulp, paper & allied products	778	829	996	1,060	1,097	1,094	1,103	1,101
Primary forest products	739	766	939	1,002	1,055	1,086	1,112	1,139
Lumber & wood products	368	308	397	469	597	649	675	670
Total forest products	1,885	1,903	2,332	2,531	2,749	2,829	2,890	2,910
All rail carloadings	18,800	18,498	21,618	22,598	23,876	23,373	23,173	23,457

Source: Assn. of American Railroads

deregulation. The freight index for pulp, paper and allied products jumped 13.1% in 1979, 18.4% in 1980 and 15.9% in 1981, according to Bureau of Labor Statistics data. But in 1983 the freight price index almost came to a standstill, showing only a 1.3% increase from 1982. June 1984 figures, however, showed an increase of 4,3% over June 1983.

Athough no index is available for ocean shipping, rates also increased sharply over the 1979-1981 period, but weakened in the recession due to increased competition among shipping lines. The cost of shipping pulp and paper from Atlantic mills to northern European ports is estimated at around $60 to $80/metric ton. The cost of shipping to the Far East from West Coast U.S. mills is roughly similar, and less than the cost of shipping by rail to northeastern markets, which are more effectively served by mills in the South and eastern Canada. This has gradually contributed to an increasing export orientation for West Coast mills.

Railroad carloadings. In 1983, U.S. railroad carloadings of pulp and paper and allied products totaled 778,000 cars, down 6.6% or 51,000 cars from the previous year. This placed the industry in sixth place among major industrial rail shippers, accounting for 4.1% of all carloadings. If primary forest, lumber and wood products are included, the entire forest products industry ranked second only to coal in total 1983 carloadings and accounted for 10% of total loadings.

RESEARCH & DEVELOPMENT SPENDING

Pulp and paper manufacturing is a mature technology and the industry is not a heavy spender on research and development. In 1983, 15 U.S. paper companies for which data were available had R&D outlays amounting to 1.0% of sales, compared with an average of about 2.6% for all U.S. industry. In the paper industry, R&D spending per employee was $1,083 in 1983, compared with an average of $2,983 for all types of business.

For 1984, the paper industry planned to boost R&D outlays by 5.2% to $560 million, vs a 8.3% boost by all U.S. industry, according to a survey taken by McGraw-Hill. However, over the next three years, paper companies plan to increase outlays another 26.5% to $673 million, nearly matching the 27.2% increase planned by all industry for the same period.

The emphasis in R&D for 1983 was nearly all on new processes (71%). Improvements of existing products received 22% of available funds with new products accounting for only 6% of R&D funds. Percentages in 1984 are projected to remain the same.

Helping to stimulate R&D spending are tax measures passed by Congress in 1981. The Economic Recovery Tax Act legislated in August 1981 gives firms a 25% tax credit for R&D expenditures in excess of the average spent in the three previous years. In addition, the act includes faster write-off of plant and equipment, and equipment used for R&D purchased after December 31, 1980, may be written off in three years.

More important in spurring R&D activity by the paper industry, however, should be competitive inroads by the plastics and electronics industries, both of which have higher levels of research spending. Dr. Edwin A. Gee, former chairman and CEO of International Paper Co. and a former E.I. du Pont de Nemours executive, points out that R&D spending in the chemical industry is 3%, vs 1% for paper. "We must better exploit our nature-given opportunities by building an R&D base that will give us a technological edge," he has said. "This could provide us with a long-term advantage over the chemical industry, based as it is on nonrenewable resources."

Among subjects high on research agendas in the paper industry are forest genetics and reforestation techniques, wholetree utilization, pulpmaking processes

U.S. PAPER INDUSTRY R&D SPENDING vs OTHER MAJOR INDUSTRIES

(millions of $)

Industry	**1982**	**1983**	**1984**	**1987**	**1983–84 % change**	**1983–87 % change**
Nonferrous metals	$ 325	$ 307	$ 350	$ 450	13.9%	46.6%
Stone, clay & glass	460	517	528	709	2.1	37.1
Chemicals	6,588	7,308	8,186	10,363	12.0	41.8
Paper & pulp	626	532	560	673	5.2	26.5
Rubber & plastics	888	1,491	1,691	2,349	13.4	57.5
Petroleum	2,248	2,213	2,265	2,573	2.3	16.3
Food & beverage	752	797	879	1,215	10.3	52.4
Textile mill products/apparel	129	142	149	178	4.7	25.4

Source: Bureau of the Census.

utilizing hardwoods, water- and air-quality analyses and control, improved energy use and recovery technology, new types of wet- and dry-forming of paper, computer process control, use of chemicals and fuel from byproducts and waste, and coating and packaging technologies—to name a few.

The industry leader in R&D spending is Kimberly-Clark Corp., which spent $53.1 million in 1983, amounting to 1.6% of its total 1983 sales. Mead Corp., which produces mainly printing and writing papers but also has an electronic database service, had the highest ratio of R&D spending to sales, 2.1%. Union Camp Corp. averaged 1.6%, while Westvaco Corp. spent 1.3% of sales toward R&D—with the high level of spending perhaps partly due to specialty chemical operations. Scott Paper Co.'s outlays averaged 1.2% of sales, reflecting heavy R&D spending in the tissue segment of the industry.

A significant amount of pulp and paper research is also performed by supplier companies, as well as by university and government institutes. Suppliers which perform a substantial amount of research work for the industry include manufacturers of pulp and papermaking equipment, felts and fabrics, computer control systems, and chemicals.

Leading research institutes specializing in paper science include the Institute of Paper Chemistry at Appleton, Wis., U.S. Forest Products Laboratory at Madison, Wis., and the Pulp and Paper Research Institute of Canada at Pointe Claire, Que.

R&D SPENDING BY INDIVIDUAL PAPER COMPANIES

	1983 R&D spending (millions of $)	% change 1982–83	1983 R&D expenditures (as % of sales)	(per employee)
Boise Cascade	$ 6.0	33.3%	0.2%	$ 210
Crown Zellerbach	12.3	−12.8	0.5	659
Fort Howard	3.4	52.6	0.4	230
Hammermill	5.9	34.1	0.4	454
James River	18.3	139.1	1.1	989
Kimberly-Clark	53.1	11.8	1.6	1,569
Mead	49.0	16.7	2.1	2,882
St. Regis	13.4	8.2	0.5	516
Scott	29.3	−2.2	1.2	1,723
Union Camp	26.6	29.4	1.6	1,538
Westvaco	19.9	4.6	1.3	1,338
Weyerhaeuser	46.9	−4.0	1.0	1,172
Total paper industry	**300.8**	**10.6**	**1.0**	**1,083**

Source: 10-K statements, annual reports.

ENVIRONMENTAL SPENDING AND REGULATIONS

As a result of environmental legislation passed in the 1970s, the U.S. pulp and paper industry embarked on a massive cleanup program. Environmental outlays claimed more than 20% of total paper industry capital spending in the early 1970s (with the percentage running to more than 30% for primary mills). Total dollar outlays by the paper industry peaked in 1976 as deadlines under major air and water legislation were reached, and in recent years pollution control spending has run about 5% to 7% of total industry capital expenditures.

The National Council of the Paper Industry for Air & Stream Improvement Inc. (NCASI) estimates that total outlays by primary mills for air, water and solid waste through 1980 have amounted to more than $5 billion dollars, up from an estimated $700 million spent by the industry for environmental improvement through 1969. Of this, $2.6 billion has been spent on water quality, $2.2 billion on air quality, and $200,000 on solid waste disposal.

Current spending. The U.S. paper and allied products industry plans to spend $390 million on pollution abatement in 1984, up a hefty 56% over the 1983 spending of $250 million, according to a Dept. of Commerce survey conducted in 1983. The industry's pollution control spending will account for 5.5% of its total capital spending.

The largest share of planned spending by the pulp and paper industry will be used for air pollution control—$220 million, or roughly 56% of total environmental spending. Air-quality protection spending reflects a continuing effort to boost kraft recovery furnace capacity and add-on control technology to reduce sulfur emissions, as well as costs for high-efficiency particulate collection equipment on power boilers and process equipment. Reduced sulfur emission guidelines for existing kraft mills during 1984 and 1985, and efforts to reduce reliance on oil as a fuel source by substituting wood residues or coal will add to ongoing expenditures for air-quality emission control.

Water pollution spending for the control, treatment and disposal of liquid effluents will take $100 million in 1984, or 26%. Solid waste control will take $70 million or 18%. Expenditures in the latter category by the pulp and paper industry will include spending for solid waste disposal resulting from waste treatment and on-site manufacturing operations: spending for trucks, land used for disposal operations, incinerators, etc. With more rigid solid waste disposal regulations now put in place by the Environmental Protection Agency, spending can be expected to continue to rise.

U.S. business as a whole plans to spend $7.6 billion for pollution control in 1984, or 2.3% of its total capital budget, compared with $7.2 billion, or 2.4% in 1983. Industries planning the largest allocations are blast

U.S. PAPER INDUSTRY SPENDING FOR POLLUTION ABATEMENT EQUIPMENT

(millions of $)

	Air	Water	Solid waste	Total	% of total capital spending
1984pl	$220	100	70	390	5.5%
1983p	160	70	20	250	4.0
1982	150	90	60	300	5.0
1981	160	120	110	380	5.7
1980	160	160	70	390	5.7
1979	133	124	40	297	6.1
1978	105	103	31	239	7.1
1977	188	256	23	468	13.8
1976	182	304	25	511	14.7
1975	273	189	27	489	16.8
1974	308	158	25	491	19.3
1973	174	181	14	369	19.5

pl = Planned
p = Preliminary

Source: Dept. of Commerce.

furnaces and steel works, 8.9%; electric utilities, 7.4%; primary metals, 6.9%; nonferrous metals, 6.2%; petroleum, 5.7%; paper, 5.5%; and chemicals, 3.8%. Of industries expecting to spend over $200 million in 1984, the largest increases are planned by paper, 56%; nonferrous metals, 31%; and mining, 6%. The two industries that spend the most for antipollution plant and equipment—electric utilities and petroleum—plan decreases of 0.4% and 3.3%, respectively.

1984 Legislative action. Although acid rain legislation was a dominant political issue during 1984, procedures for funding the legislation could not be agreed upon and the legislation failed to pass Congress. Another problem faced by the supporters of the legislation was the continuing controversy over the cause of acid rain, about which no general consensus has been reached even though a number of studies have been made.

Congress also failed to reauthorize Superfund, which expires Oct. 1, 1985. Superfund was set up in 1980 to address the cleanup of toxic waste sites around the country. Again, the problem was not whether or not to spend the funds, but where the funds for the program were to come from. However, Superfund is still expected to be reauthorized in 1985.

For the largest of the hazardous-waste landfills, the EPA developed tougher standards in 1984 which are designed to prevent groundwater contamination. The agency officials believe the new rules will force closure in 1985 of the most dangerous, leaking landfills and will require other substandard facilities to install expensive underground water-monitoring equipment by 1988 or 1989. The EPA has also spelled out a strategy to target enforcement efforts against those dumps that pose the greatest health hazard to nearby residents.

On July 1, 1984, pulp and paper industry direct dischargers were to be in compliance with federal best available technology (BAT) standards regarding wastewater discharges. Effluent guidelines and standards apply to facilities which discharge process wastewater, or any water, to waters of the U.S., or that introduce process wastewater into a publicly owned treatment works or municipal sanitary sewage system.

ENVIRONMENTAL LEGISLATION AFFECTING THE PULP AND PAPER INDUSTRY SINCE 1970

1970

Air Quality Standards Act
(Clean Air Act)
(P.L. 91-604)

Water Quality Improvement Act
(P.L. 91-224)

Resource Recovery Act
(P.L. 91-512)

Occupational Safety & Health Act
(P.L. 91-596)

1972

Water Pollution Control Act Amendments
(P.L. 92-500)

Environmental Pesticide Control Act
(P.L. 92-516)

1973

Clean Air Act Amendments
(P.L. 93-15)

1974

Safe Drinking Water Act
(P.L. 93-523)

Clean Air Act Amendments
(P.L. 93-319)

1976

Toxic Substances Control Act
(P.L. 94-469)

Resource Conservation & Recovery Act
(P.L. 94-580)

1977

Clean Air Act Amendments
(P.L. 95-95)

Clean Water Act Amendments
(P.L. 95-217)

1978

Resource Conservation & Recovery Act Amendments
(P.L. 95-509)

1980

Solid Waste Disposal Act
(P.L. 96-482)

Comprehensive Response, Compensation & Liability Act (Superfund)
(P.L. 96-510)

PAPER MACHINERY

Paper industry machinery manufacturers had another rough year in 1983, as shipments in constant-dollar terms fell for the fourth straight year to their lowest level since 1972. Despite record production levels and high operating rates in most segments of the paper industry, machinery makers will have to wait until 1985 to benefit from the current economic upswing, according to the Dept. of Commerce's *U.S. Industrial Outlook 1984*.

Due to long lead times and the reluctance of papermakers to commit themselves to capital improvements until a recovery is fully underway, recovery in the paper machinery sector traditionally lags a general upturn by a year or more. Making matters worse for machinery suppliers, papermakers seem to be favoring, more than in the past, less-costly rebuilds and incremental expansions over new installations. Traditionally accounting for about 60% of capital spending, rebuilds may now account for as much as 70% of orders, the Commerce Dept. says.

Paper machinery makers are highly specialized in products for the paper industry. Manufacturers in 1982 shipped $1.091 billion worth of products primary to the paper industry, $178 million worth of secondary products not used by the paper industry, and had an additional $72 million in miscellaneous receipts, according to preliminary Census Bureau data. This translates into a specialization ratio—the percentage of primary products to total shipments—of 86%, up from 84% in the 1977 Census of Manufactures. The Census Bureau also calculates that 92% of products considered primary to the paper industry are made by paper machinery manufacturers—a category which excludes process control equipment, among other products. This 92% "coverage ratio" is up from 90% in 1977.

Shipment values drop. Paper machinery manufacturers shipped $1.344 billion worth of goods in 1983, according to the Commerce Dept., down 0.5% from the previous year. In actual dollars, the value of shipments peaked in 1981 at $1.382 billion before falling 2.2% in 1982 to $1.351 billion. While the value of shipments grew at a compound annual rate of 10.3% over the 1972-83 period, this was a measure of inflation rather than real growth: in constant dollars, the value of shipments declined 1.2%/year over the 10-year period.

Total shipments of paper industry machinery—including goods produced by manufacturers outside the basic paper machinery industry—amounted to $1.134 billion in 1983, down 0.9% from 1982. The 1982 figure of $1.144 billion was down 2.8% from the peak of $1.177 billion reached in 1981.

In constant 1972 dollars, paper machinery industry shipments amounted to approximately $394 million in 1983, down 4.0% from 1982. The Commerce Dept. expected shipments to decline again in 1984, dropping

CATEGORIES OF PAPER MACHINERY*

Wood preparation. Machinery involved from the receipt of rough wood at the mill yard to delivery of prepared wood or chips to the pulp mill.

Pulp manufacturing. All equipment required for processing wood or other raw fiber into pulp for delivery to stock preparation, including chemical recovery equipment.

Pulp refining. Processing of pulp fiber for delivery to the paper machine(s).

Paper and paperboard manufacturing. From the headbox through the machine winder.

Finishing. Supercalenders, winders, sheeters, and sheet and roll wrapping equipment.

Converting. Coaters, laminators, embossers, saturators, corrugators and fabricating equipment. . .boxes, cores, bags, envelopes.

* Based on classification scheme proposed by the Pulp & Paper Manufacturers' Assn. for use by the Bureau of Census in collecting statistical information.

1.8% to $387 million—a 22% decline from the 1979 high of $495 million. The drop-off was expected to mask a pickup in shipments late in the year, however, as deliveries were made on orders received in 1983 and early 1984. New orders in early 1984 were expected to jump 10% from 1983 levels, as projects delayed by the recession were put back on track.

The value of all paper machinery shipments—again including goods produced by manufacturers outside the basic industry—was expected to follow a similar but slightly steeper downward curve. After falling 4.4% from 1982 levels, the value of shipments was forecast to fall another 2.3% in 1984, to $325.0 million in constant 1972 dollars.

Foreign inroads. Although U.S. exports of paper machinery grew at a brisk 9.8% annual rate between 1972 and 1983, imports grew at a much healthier 16.2% annual rate. Imports grew steadily as a percentage of total shipments throughout the 1970s and into the current decade, rising from 12.4% in 1972 to 20.0% in 1979 and 21.4% in 1983. In addition to cutting the market share of domestic suppliers, growing imports easily outpaced U.S. exports, culminating in 1979 in the U.S. industry's first-ever trade deficit. Although the historical surpluses reappeared in the first years of the 1980s, the trade deficit returned in 1983, when imports climbed to a new high of $287 million, 39% higher than the previous year, and exports dropped 31% to an estimated $217 million.

The Commerce Dept. expects exports to climb 8% in 1984 to $234 million, but the increase will be more than offset by higher imports, which are expected to jump 13% to $325 million, increasing the trade deficit. Higher exports may depend on the health of the Mexican economy, since Mexico has traditionally been second only to Canada as a market for U.S. paper machinery exports. Exports to Mexico plummeted from $54 million in 1982 to only $3 million in 1983.

Paper machines. The overall trend toward increasing import penetration is easily seen in the case of paper machines, the biggest ticket item among various categories of paper machinery. Foreign suppliers—mainly from Scandinavia and Fed. Rep. Germany—account for an increasing number of the new machines started up in the U.S. In the 1974-76 period, for example, 17 of the 20 new paper machines that came online were supplied by U.S. manufacturers. From 1980 to 1984, however, 16 of the 31 new machines installed in the U.S. have been from European suppliers. And of eight machines now scheduled to come online over the next several years, three will be supplied by a U.S. supplier and five by Europeans.

A number of reasons have been advanced for the increasing success of foreign suppliers in the U.S. Price is probably the biggest headache for U.S. producers: in a survey conducted by the U.S. Pulp & Paper Machinery Manufacturers' Assn. in 1982, 68% of the U.S. paper companies interviewed said that terms offered by foreign suppliers were better than those of U.S. suppliers, while only 12% found U.S. terms better. Since then, the strength of the dollar has made this problem worse for U.S. manufacturers.

Another sore point involves technology. Only 16% of paper companies surveyed said the U.S. was better in technology, while 44% reported equivalence between U.S. and foreign equipment. A significant 40% judged foreign suppliers superior in this area.

Long-term outlook. For the five-year period from

MANUFACTURERS BY COUNTRY OF NEW PAPER MACHINES STARTED UP IN U.S., 1974-84

(Number of machines)

Manufacturer	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	Beyond 1984	Total
Allis-Chalmers (U.S.)	1	—	—	—	1	—	—	—	—	—	—	—	1
Beloit (U.S.)	4	3	6	4	—	7	5	1	5	1	2	3	41
Black Clawson (U.S.)	1	—	1	—	—	—	—	—	—	—	—	—	2
Manchester (U.S.)	—	1	—	—	—	—	1	—	—	—	—	—	2
Dominion (Canada)	1	—	—	—	—	—	—	—	—	—	—	—	1
Holder (U.K.)	—	—	—	—	1	—	—	—	—	—	—	—	1
KMW (Sweden)	—	—	—	—	—	1	—	1	—	—	—	—	2
Sulzer-Escher Wyss (W. Germany)	—	—	—	—	—	—	—	—	—	—	—	1	1
Tampella (Finland)	1	1	—	—	1	—	2	2	1	—	—	1	9
Valmet (Finland)	—	—	—	—	—	1	—	4	1	1	—	1	8
Voith (W. Germany)	—	—	—	1	1	—	2	1	—	—	1	2	8
Total U.S.	6	4	7	4	1	7	6	1	5	1	2	3	46
Total foreign	2	1	—	1	3	2	4	8	2	1	1	5	30

Source: PULP & PAPER PROJECT REPORT.

1983 to 1988, the Commerce Dept. expects industry shipments to rebound somewhat, with annual compound growth rates of 3.5%. This modest rate of growth contrasts with a projected growth rate of 8.5% for nonelectrical machinery as a whole. Paper machinery shipments in 1988 are forecast at $464 million in constant 1972 dollars—better than current conditions but still 6% below the 1979 high. Most of the projected improvement is seen coming in 1985 and 1986.

Technological improvements are expected to continue as papermakers seek to expand profits by improving efficiency. Such changes include higher-yield pulping processes, better chemical recovery, and improved energy efficiency, particularly in drying paper. New technology is also helping mills make better paper. Along these lines, the growing demand for higher quality—brighter, more uniform paper, with better print characteristics—is being met by improvements in twin-wire formers and the rapid growth in microprocessor-based control systems.

Major suppliers. Beloit Corp. is by far the largest domestic U.S. paper machine supplier, followed by Black Clawson Co. in second place. Both companies produce a wide range of paper machinery and operate plants in other parts of the world. European paper machine suppliers active in the U.S. include Oy Tampella AB and Valmet Oy of Finland, KMW AB of Sweden, and Sulzer-Escher Wyss GmbH and J.M. Voith GmbH of Fed. Rep. Germany. All of these foreign manufacturers have established U.S. marketing arms in recent years. In addition, Valmet in 1984 formed a joint venture with Canadian paper machine maker Dominion Engineering Works Ltd. to manufacture and sell paper machines in North America.

Kamyr AB of Sweden is the dominant world supplier of continuous digesters. A. Ahlström Corp. of Finland, Fläkt Industri AB and Sunds Defibrator of Sweden, Hymac Ltd. of Canada, and Sprout-Waldron Div. of Koppers Co. Inc. of the U.S. are other important suppliers of pulping equipment. Major suppliers of power and recovery boilers include Babcock & Wilcox Co., Combustion Engineering Inc. and Foster Wheeler Corp., all of the U.S., and Götaverken AB of Sweden. Furthering a trend in the industry toward internationalization, a number of foreign manufacturers, including most of those listed above, have established manufacturing bases in the U.S.

A number of firms supply process control equipment to the paper industry, most of them from the U.S. Three of the largest are AccuRay Corp., Measurex Corp. and Foxboro Co.

AD VALOREM TARIFFS CHARGED BY VARIOUS COUNTRIES ON IMPORTS OF PAPER AND BOARD MANUFACTURING MACHINERY

(Brussels Tariff Nomenclature 84-31)

Country	Current	Projected Jan. 1, 1987
United States[1]	2.6%	Duty free
Finland	6.9%	5.1%
Fed. Rep. Germany[3]	4.7%	3.8%
United Kingdom[3]	4.7%	3.8%
Canada[2]	13.6%	9.2%
Japan	5.7%	n.a.
Brazil	45.0% + 5% V.A.T.	n.a.

[1] TSUS 66800.40.
[2] Converting machinery is duty-free.
[3] Other converting machinery is currently 5.2%.

PULP & PAPER MACHINERY INDUSTRY (SIC 3554) SHIPMENTS, EXPORTS AND IMPORTS, 1974-84

(millions of $)

	1984e	1983	1982	1981	1980	1979	1978	1976	1974
Shipments	n.a.	1,344.0	1,351.0	1,382.3	n.a.	1.207.6	938.9	869.3	723.8
Exports	234.0	217.0	315.6	351.4	318.4	232.6	177.7	191.8	151.4
Imports	325.0	287.0	206.6	272.6	253.8	246.4	182.3	109.5	89.8
Ratios									
Imports/ shipments (%)	n.a.	21.4	15.3	19.7	n.a	20.0	19.0	12.0	12.0
Exports/ imports	0.72	0.76	1.53	1.29	1.25	0.94	0.97	1.75	1.68

n.a. = Not available.

Source: U.S. Dept. of Commerce.

CANADA

INDUSTRY STRUCTURE

About 80 corporate entities manufacture pulp, paper or paperboard in Canada, operating about 115 paper and board mills and 108 pulp mill sites (companies with combined pulp and paper capacity of 1,000 tpd or more are listed in the "Major firms" section of Company Profiles). A total of 142 manufacturing establishments were listed by Statistics Canada in 1982 in its annual "Pulp and Paper Mills" survey of the industry.

The largest number of establishments employ between 200 and 499 workers, and 500 and 999 workers

LEADING CANADIAN FIRMS

(1983 sales for firms with capacity of 900 metric tpd or over)

Rank	Company	1983 sales	Pulp capacity (rank)	Pulp capacity (m tpd)	Paper/board capacity (rank)	Paper/board capacity (m tpd)
1	MacMillan Bloedel	C$2,044,100,000	2	6,528	2	4,901
2	Domtar Inc.	1,820,000,000	5	3,527	4	3,866
3	Abitibi-Price Inc.	1,660,180,000	1	7,797	1	7,125
4	Consolidated-Bathurst	1,393,065,000	4	5,188	5	3,856
5	Canfor Corp.	995,100,000	11	1,764	20	300
6	B.C. Forest Products	899,676,000	7	2,801	6	3,054
7	Crown Forest Industries	727,300,000	9	2,286	11	1,370
8	Great Lakes Forest Prods.	494,981,000	6	3,060	10	1,535
9	Fraser Inc.	435,913,000	17	1,238	9	1,551
10	Eddy Paper Co. Ltd.	429,971,000	21	830	17	892
11	Donohue Inc.	357,342,000	14	1,597	12	1,163
12	Westar Timber Ltd.	338,600,000	13	1,700	—	—
13	Ontario Paper Co.	337,533,000	8	2,476	7	2,180
14	Northwood Pulp & Timber	291,400,000	16	1,450	—	—
15	Eurocan Pulp & Paper	181,000,000	19	950	15	1,010
16	James Maclaren Industries	164,900,000	22	828	19	430
17	Cascades Inc.	62,033,000	23	669	14	1,151
	Data not available					
	CIP Inc.	n.a.	3	5,910	3	4,855
	Irving Pulp & Paper	n.a.	15	1,575	13	1,155
	Kruger Inc.	n.a.	10	1,863	8	1,923
	Reed Paper Ltd.	n.a.	18	1,130	16	1,000
	Repap Enterprises	n.a.	12	1,760	18	835
	Western Pulp LP	n.a.	20	905	—	—

Source: Compiled from data in Company Profiles section.

(45 in the first group, 39 in the second), with only 24 establishments having 1,000 or more workers on-site and the balance having fewer than 200. The mills with over 1,000 workers lead in terms of salaries and wages paid, value of goods manufactured and value added.

Geographic center of the industry is in Quebec, with 6.0 million metric tons of paper and paperboard produced in 1983 compared with 3.4 million tons in Ontario and 2.2 million tons in British Columbia, and with 1.9 million tons in the other provinces. Quebec also led in woodpulp output, with 6.8 million metric tons compared with 6.1 million tons in British Columbia and 4.2 million tons in Ontario, and 3.8 million tons in the other provinces.

Productive capacity is less concentrated in the pulp and paper industry than in many other sectors of the Canadian economy, but the capital-intensive nature of the industry is gradually increasing the level of concentration in many areas of Canadian pulp and paper.

The bulk of Canadian production goes into market pulp and newsprint, with those two commodities representing between them 76% of total 1983 pulp, paper and board shipments.

Similarly, exports are far more important for the industry than domestic shipments, with exports representing 76% of all shipments in 1983. Pulp and paper exports in 1983 represented 9.1% of all Canadian exports in terms of dollar value, according to Canadian Pulp & Paper Assn. Indeed, pulp and paper is Canada's most important generator of export revenues, bringing in C$8.2 billion in 1982 almost $1 billion more than the number two industry, autos and chassis.

Pulp and paper is also the largest Canadian industry in terms of wages and salaries paid, total employment and value added by manufacture, and second in terms of the selling value of factory shipments, according to StatCan.

The importance of the industry to the Canadian economy in general and to Canadian exports in particular has fallen over the last 30 years, however. StatCan figures show that the 9.1% share of total exports claimed by pulp and paper mills in 1983 was down from 21.3% in 1952. Pulp and paper represented 2.8% of the Canadian gross national product in 1983, down from 5.0% in 1952.

Pulp and paper workers in Canada earned an average of C$613.37/week in 1983, the highest of any major industry, followed by smelting and refining workers, who made just under C$596/week.

PULP, PAPER AND BOARD MILLS IN CANADA

(Number of millsites)*

	Paper/ board mills¹	Pulp mills
Alberta	3	2
British Columbia	10	22
Manitoba	4	3
New Brunswick	6	10
Newfoundland	3	3
Nova Scotia	4	5
Ontario	32	23
Quebec	53	39
Saskatchewan	—	1
Total	115	108

* Integrated mills producing both pulp and paper are counted twice once as a pulp and once as a paper mill. Pulp mills producing two or more different types of pulp are counted only once.

1. Molded pulp products not included in tabulations.

Source: Post's Pulp & Paper Directory (1985)

TEN LEADING CANADIAN MANUFACTURING INDUSTRIES, 1981*

	Number of employees	Wages, salaries (C$000)	Selling value of shipments (C$000)
Pulp and paper	87,882	2,309,802	11,619,310
Sawmills and planing mills	64,486	1,413,330	4,972,733
Misc. machinery/equipment	72,232	1,519,386	5,825,037
Iron and steel mills	56,543	1,407,299	6,996,869
Motor vehicle parts, accessories	49,300	1,133,284	4,358,411
Motor vehicles	44,267	1,902,087	11,402,832
Slaughter/meat processing	35,450	706,004	7,603,018
Metal stamping and pressing	26,823	547,751	3,390,404
Dairy products	26,196	513,275	4,882,843
Petroleum refiners	21,325	657,519	19,957,988

* Latest available.

Source: Statistics Canada.

PRODUCTION, EXPORTS/IMPORTS

Production at Canadian mills began to recover in 1983 from the off-years of 1981-82, and that rebound continued strongly for most grades in 1984. The performance of 1985 may be less robust in terms of year-over-year growth, but the industry on the whole was expecting healthy conditions to last through the year.

If year-over-year growth is slower than it was in 1983-84, it may be because 1984 will be a hard act to follow for many grades. Mills that racked up increases near the double-digit range for some products last year will see fairly small rises in 1985. Furthermore, the North American economic recovery is clearly maturing, which on its own should lead to slower — although still acceptable — growth.

Indeed, any growth at all is not to be sneezed at in the 1980s. Canadian industry produced just under 13.5 million metric tons of paper and board in 1979, and about 100,000 tons less in 1980. Then, output topped 13.5 million tons in 1981 only to tumble by more than one million tons in 1982. In 1983, production returned almost to the 1980 level and seemed on its way to a possible record in 1984. If that indeed turned out to be the case, 1983-84 would be the first time production grew for two consecutive years in the 1979-84 period.

Some growth in market pulp production was also expected in 1985, simply because 1984 output of bleached softwood kraft pulp was artificially depressed by a two-month strike in British Columbia at the beginning of the year. Conditions in pulp markets were soft going into 1985, however, so any growth during the year was expected to be modest.

Record newsprint output. Canada's other large industry sector, newsprint, will probably show slow growth in 1985 too, simply because 1984 was so good. The industry's performance in 1984 would have been even better, had it not been for the same British Columbia strike that hurt market pulp. But even with that shutdown, newsprint mills nationwide seemed on the verge of a 6% production increase in 1984, while Canadian newsprint output in 1985 seemed unlikely to grow at much more than half that pace.

If newsprint output in 1984 did end up 6% higher than in 1983, it would bring it back to or slightly above the record 8.9-million-ton output of 1981. Its companion grade, uncoated groundwood, was already well into record territory when November ended, with

CANADIAN DOLLAR VALUE IN U.S. DOLLARS

(average for year)

Year	C$ — US$	Year	C$ — US$
1978	0.877		
1977	0.938	1984	0.762*
1976	1.014	1983	0.812
1975	0.982	1982	0.811
1974	1.022	1981	0.834
1973	1.000	1980	0.855
1972	1.000	1979	0.854

* 3rd quarter 1984

Source: PULP & PAPER PRICEBOOK

TOP CANADIAN PROVINCES IN PULP AND PAPER/PAPERBOARD PRODUCTION, 1983

('000 metric tons)

Pulp		Paper/Paperboard*	
1. Quebec	6,762	1. Quebec	6,049
2. British Columbia	6,143	2. Ontario	3,388
3. Ontario	4,212	3. British Columbia	2,164

* Excludes building board.

Source: Canadian Pulp & Paper Assn. estimates.

60,000 tons more paper produced in the first 11 months of 1984 than in all of 1983. Due to conversion of old newsprint machines to produce groundwood specialties, plus startup of a new Consolidated-Bathurst Inc. machine—and possibly because of changed reporting practices on the part of some Canadian companies—the output of Canadian groundwood specialties grew in each year of the 1979-84 period.

In the higher-grade area of the paper industry, book and writing papers slowly regained ground lost in the recession years of the early 1980s. Production in the first 11 months of 1984 shot up by 9.2% and had already surpassed the full-year output of any year in the decade except 1983. Book/writing mills produced 914,000 tons of paper in 1979 and then saw output drop the next two years in a row before rebounding modestly in 1982. Exports, particularly to the U.S., gave the industry a real shot in the arm in 1983-84. Both Great Lakes Forest Products Ltd. and Island Paper Mills Ltd. started up new machines in that period as well.

In other grades of paper, however, the story was not so upbeat. Kraft paper production dropped steadily in the 1980s, rising by about 4% in 1983 but dropping again by 7.6% in the first 11 months of 1984. And tissue production bounced along on a level during the period, rising two years in a row only once: in 1983-84, assuming December 1984 continued the trend of the first 11 months of that year.

If kraft paper was hurting badly in the 1980s, containerboard was not. Output rose in 1980, fell modestly the next year and tumbled by 13.3% in 1982, only to bounce back by about the same amount in 1983. Then, in the first 11 months of 1984, production jumped another 8.7% and seemed destined to end the year at or above 1980's performance.

Boxboard zig-zagged during the early 1980s, dropping in 1980, rising in 1981, falling the next year and bouncing back the following year. With a 6.1% jump in the first 11 months of 1984, output seemed destined to end 1984 at about the 742,000-ton level of 1979.

Regarding operating rates, the industry was on respectable ground in the low-to-mid-90s in 1984, having fallen to the low 80s—or below—in 1982 and the mid-to-high 80s in 1983. With capacity virtually flat for most grades, those healthy operating rates should pertain in 1985 as well.

B.C. strike hurts pulp production. The other important area of the Canadian industry, pulp, was clearly affected by the labor-related shutdown of early 1984. Bleached softwood sulfate market pulp shipments fell

CANADIAN PAPER AND PAPERBOARD PRODUCTION BY MAJOR GRADES, 1979-84

(000 metric tons)

	Jan.-Nov. 1984	% change year ago	1983	1982	1981	1980	1979
PAPER							
Newsprint	8,275	+5.9%	8,486	8,117	8,946	8,625	8,709
Groundwood printing, specialties	825	+21.5	765	649	645	614	611
Book & writing	959	+9.2	961	831	786	895	914
Kraft papers	400	−7.6	472	453	490	533	588
Tissue, special papers	367	+1.9	385	375	388	377	381
Total paper	10,826	+6.5	11,069	10,425	11,255	11,045	11,203
PAPERBOARD							
Containerboard	1,569	+8.7	1,537	1,365	1,574	1,671	1,541
Linerboard	1,004	+7.4	1,022	887	1,087	1,175	1,075
Corrugating medium	565	+11.2	551	478	487	496	466
Boxboard	693	+6.1	711	618	701	673	742
Total paperboard	2,262	+7.9	2,284	1,983	2,275	2,344	2,283
TOTAL PAPER & BOARD	13,088	+6.8	13,353	12,408	13,530	13,389	13,486
OPERATING RATES							
Newsprint	92%	85%*	85%	82%	94%	94%	97%
Other papers	95	88*	88	82	83	88	99
Paperboard	93	88*	88	74	89	95	91

* Year-ago operating rates (first 11 months, 1984)

Source: Canadian Pulp & Paper Assn.

by 4.0% through November of 1984, although bleached hardwood kraft shot up by 21.7% and was already at record levels.

Other than bleached softwood kraft, most market pulp grades showed respectable increases in 1984. Bleached sulfite and the dissolving/special alpha grades, losing sway as important Canadian products, nevertheless jumped by 13.8% and 6.3%, respectively, in the first 11 months of the year. Market pulp overall was up 2.4% through November 1984.

Total woodpulp production turned in a healthier performance in 1984, rising 5.3% in the first 11 months of the year. Overall bleached softwood kraft output was down only 2.8% and mechanical pulp, on the strength of the healthy showing of newsprint, was headed for a new record. Overall, pulp production in 1984 seemed certain

CANADIAN PULP AND PAPER EXPORTS BY MAJOR GRADES, 1979-84

(000 metric tons)

	Jan.-Nov. 1984	% change year ago	1983	1982	1981	1980	1979
WOODPULP							
Bleached sulfite	259	+11.6	255	253	349	355	369
Unbleached sulfite	47	−4.1	52	62	93	102	81
Bleached softwood sulfate	4,150	−6.0	4,941	4,200	4,616	5,049	4,791
Bleached hardwood sulfate	660	+33.3	541	366	399	381	363
Semibleached sulfate	319	−1.8	377	320	407	496	457
Unbleached sulfate	143	−13.3	186	171	212	221	256
Mechanical	349	+57.9	245	232	257	294	99
Total chemical paper-grade	5,579	−1.8	6,352	5,372	6,076	6,610	6,331
Dissolving, special alpha	189	+5.6	198	219	258	291	351
Total woodpulp	6,118	+0.6	6,795	5,823	6,591	7,195	6,782
PAPER/PAPERBOARD							
Newsprint	7,289	+6.8	7,469	7,139	7,871	7,642	7,783
Groundwood printing	693	+22.7	636	546	523	517	486
Book, writing	249	+14.7	239	174	127	201	204
Kraft papers	177	−17.3	234	218	207	241	240
Tissue	31	+47.6	24	24	25	24	33
Containerboard	433	+3.8	461	356	360	458	350
Linerboard	245	0	268	220	256	346	254
Corrugating medium	188	+9.3	193	136	103	112	96
Boxboard	70	+34.6	57	28	40	38	64
Total paper/paperboard	8,922	+7.3	9,120	8,485	9,153	9,121	9,160

Source: Canadian Pulp & Paper Assn.

CANADIAN NEWSPRINT EXPORTS BY DESTINATION, 1979-84

(000 metric tons)

	Jan.-Nov. 1984	% change year ago	1983	1982	1981	1980	1979
United States	6,038	+9.8	6,033	5,614	6,062	6,117	6,347
United Kingdom	354	−24.7	502	541	541	442	398
Other Western Europe	132	−7.0	163	170	189	181	187
Latin America	339	−13.7	428	471	625	518	445
Asia	308	+40.0	246	240	356	267	247
Other countries	119	+16.7	97	103	98	116	159
Total	7,728	+6.8	7,469	7,139	7,871	7,641	7,783

Source: Canadian Pulp & Paper Assn.

to wipe out bad memories left over from 1982 when it fell below 19 million metric tons for the only time in the 1979-84 period. Chemical paper grade pulp mills ran at 87% in the first 11 months of 1984, one point better than in the same period of 1983 and two points better than all of 1983—and 11% ahead of 1982's dismal performance. And for some months of 1984—although this got the industry into trouble on pricing—the market pulp sector ran at better than 100% of capacity.

Export showing. Exports turned in a performance similar to that of overall Canadian production. One interesting note was the 57.9% improvement in mechanical pulp exports for the first 11 months of 1984, bringing exports of that grade to 349,000 metric tons in the January-November period—compared with 245,000 tons in all of 1983, and just 99,000 tons in 1979. Clearly, market mechanical pulp—which outstripped even bleached sulfite in 1984—is beginning to make its mark on the market, at least in the export area. A large part of this increase, however—although by no means all—is due to the inclusion of captive shipments from Consolidated-Bathurst's Bathurst, N.B., pulp mill to its Edgewater newsprint operation in the U.K.

Exports of paper and paperboard were up strongly in almost every grade in 1984, after a virtually flat performance in 1979-83 interrupted by a sharp drop in 1982. Only kraft paper showed a decline in the first 11 months of 1984, while linerboard exports were un-

CANADIAN WOODPULP PRODUCTION AND SHIPMENTS[1] BY MAJOR GRADES, 1979-84

(000 metric tons)

	Jan.-Nov. 1984	% change year ago	1983	1982	1981	1980	1979
WOODPULP PRODUCTION							
Bleached sulfite	344	+24.6	305	281	418	405	407
Unbleached sulfite	1,295	+4.6	1,353	1,444	1,819	1,763	1,833
Total sulfite	1,639	+8.3	1,658	1,725	2,237	2,168	2,240
Bleached softwood sulfate	5,087	−2.8	5,705	5,098	5,444	5,922	5,559
Bleached hardwood sulfate	1,142	+20.1	1,035	817	812	832	818
Semibleached sulfate	970	+5.0	1,022	921	1,057	1,182	1,104
Total bl & semibl sulfate	7,199	+1.3	7,762	6,836	7,313	7,936	7,481
Total white pulps	8,838	+2.5	9,420	8,561	9,550	10,104	9,721
Unbleached sulfate	1,365	+0.8	1,486	1,142	1,497	1,688	1,690
Total chem paper-grade	10,203	+2.3	10,906	9,703	11,047	11,792	11,411
Semichemical	310	+10.7	305	252	323	333	323
Mechanical	7,775	+9.3	7,778	6,815	7,631	7,706	7,388
Screenings	16	+23.1	15	17	19	26	26
Total paper-grade	18,305	+5.3	19,004	16,787	19,020	19,657	19,418
Dissolving, special alpha	206	+3.5	217	220	274	311	368
Total woodpulp	**18,511**	**+5.3**	**19,221**	**17,007**	**19,294**	**19,970**	**19,516**
MARKET PULP SHIPMENTS							
Bleached sulfite	306	+13.8	296	275	376	392	406
Unbleached sulfite	55	−1.8	61	76	105	122	111
Bleached softwood sulfate	4,574	−4.0	5,332	4,515	4,982	5,381	5,096
Bleached hardwood sulfate	829	+21.7	745	537	602	592	558
Semibleached sulfate	402	+11.4	418	356	485	579	531
Unbleached sulfate	148	−12.9	191	181	226	232	264
Total chem paper-grade	6,314	+0.2	7,043	5,940	6,776	7,298	6,966
Mechanical	425	+48.1	317	273	284	322	109
Dissolving, special alpha	202	+6.3	209	227	270	310	371
Total woodpulp	6,940	+2.4	7,569	6,440	7,330	7,930	7,446
OPERATING RATES							
Chemical paper-grade	87%	86%[2]	85%	76%	87%	95%	90%

1. Excludes pulp sent to integrated and affiliated mills inside Canada.
2. Year-ago operating rate (1st 11 months of 1983).

Source: Canadian Pulp & Paper Assn.

changed from the same period of 1983. Benefiting from a robust publication papers market in the U.S., exports of groundwood specialties boomed—rising 22.7% through November 1984. Book/writing exports benefited from competitive conditions in the U.S. market to jump by 14.7%, while, on the paperboard side, corrugating medium was up 9.3% to 188,000 tons through November—more than double the export levels for all of 1979.

As for pulp and paper/paperboard exports by region, Canada found itself in trouble in Europe in market pulp in the 1980s, and it apparently ended 1984 with market pulp shipments to Japan about where they were in 1979. Shipments to the U.S. probably ended 1984 below the 1979 levels.

But in shipments to most markets, Canadian woodpulp exports rose at healthy rates in 1984. Shipments to the U.K. are distorted, however, by the inclusion of Con-Bath deliveries to its Edgewater newsprint mill. But shipments to the U.S. through November jumped 7.2%, and to Latin America by 60.3%, while shipments to Japan edged up by 3.1%. Deliveries to Western Europe other than the U.K., however, were down by 11.6% from 1983's already-dismal performance.

Newsprint exports showed a similar pattern: healthy growth through November to the U.S. (9.8%), and to Asia (40.0%); shipments to Europe were abysmal (down 24.7% to the U.K. and 7.0% to the rest of Europe). Exports to even Latin America were down (by 13.7%), with Latin American demand suffering seriously from economic and balance-of-payments problems, while Scandinavian and South African producers took advantage of a strong dollar to undercut traditional producer/consumer relationships.

CANADIAN WOODPULP EXPORTS BY DESTINATION, 1979-84

(000 metric tons)

	Jan.-Nov. 1984	% change year ago	1983	1982	1981	1980	1979
United States	3,149	+7.2	3,289	2,857	3,240	3,433	3,577
United Kingdom	360	+41.7	272	269	328	377	408
Other Western Europe	1,265	−11.6	1,594	1,431	1,673	1,794	1,606
Latin America	125	+60.3	101	65	99	142	86
Japan	650	+3.1	744	682	682	885	689
Other countries	568	−19.9	795	520	569	564	416
Total	6,118	+0.6	6,795	5,824	6,591	7,195	6,782

Source: Canadian Pulp & Paper Assn.

PRICE AND COST TRENDS

PRICE AND THE DOLLAR

Canada's pulp and paper industry exists to serve export markets far more than to serve the domestic market, and the industry's export products are generally priced in U.S. dollars. In recent years this has been a considerable blessing for the industry, since the Canadian dollar has fallen from approximate parity with the U.S. dollar as recently as 1977 to the 76-cent (U.S.) level of late 1984—bringing with it an unearned windfall profit for exporting companies of as much as 50% to 100% of many companies' profits. In a decade when profits of any kind have sometimes been scarce, Canada's weak currency has meant the difference between life and death for parts of its pulp and paper industry.

This also means Canadian producers have had a competitive cushion that their U.S. counterparts have not enjoyed when market weakness has prevented price increases—as in the severe recession of 1982. For example, discounting was prevalent in the U.S. newsprint market in 1984, and real prices were below where they had been three years earlier. Nevertheless, eastern Canadian mills made money on sales of newsprint to the U.S. because of the dollar differential. And it is difficult to see how British Columbia's mills could have remained in business through the down period of the early 1980s without a weak Canadian dollar.

The long-term benefits of all this for Canadian mills, of course, are not so attractive, since a weak currency also brings with it high domestic inflation and an undermined domestic economy. Indeed, the cost side of the Canadian industry's price-cost equation was considerably less attractive than that facing U.S. producers by 1982, and in 1984 Canada was still attempting to bring cost factors such as labor rates back into line with U.S. levels. And the lesson should be remembered that a currency differential provides only a particular exporter with a relative advantage—price increases are needed by Canadian mills just as they are required by their U.S. competitors.

FAILED PRICE INCREASES

In the second quarter of 1980, the price of Canadian bleached softwood kraft pulp exported to northern Europe hit an all-time high of US$545/metric ton, c.i.f. delivered to Europe. Then in the first quarter of 1982, producers attempted to raise the benchmark price by a further $35. Not only did they fail, but a simultaneous worldwide recession soon drove pricing so far backward

PRICE INDEXES FOR CANADIAN PULP, PAPER AND PAPERBOARD COMMODITIES

(1971=100)

Commodity	1983	1980	1976	1972
Fine paper (writing & repro., domestic shipments)	257.6	219.0	161.6	102.5
Corrugating medium & liner (domestic ship.)	286.6	238.5	162.5	103.2
Bleached sulfite pulp (export)	303.7	342.1	218.8	97.1
Bleached sulfate pulp (export)	293.8	341.0	230.6	93.4
Unbleached sulfate pulp (export)	319.0	379.0	226.9	92.3
Newsprint (export)	337.6	300.2	177.6	102.8

Source: Statistics Canada

that by August 1982 list quotes were down to $465—where they had been in the fourth quarter of 1979, and only $30 above the previous peak in early 1975. By the first quarter of 1983 they had fallen still further, to just $410—with spot market quotes below that readily available.

As usually happens in a recovery, prices snapped back fairly rapidly, hitting $540 in the second quarter of 1984. But the fundamental effects of overcapacity—plus the distortion imposed on the market for products priced in U.S. dollars in a time of a very strong U.S. currency—combined to knock market pulp back down again, and by the end of 1984 northern bleached softwood kraft pulp was selling in northern Europe for around $470 to $480, and falling.

In the same time period, Canadian mills selling newsprint in the U.S. for US$500/metric ton tried raising their prices $25/ton in March, April and again in June of 1982, and were undermined each time by a sizable group of small and large producers which preferred to undercut the leaders' price hikes and maintain operating rates rather than support an increase and enjoy higher prices.

They were still trying in the fourth quarter of 1982 when widespread discounting forced them to reverse direction and actually cut their lists to $468.50. It was not until the third quarter of 1983 that they got the list back up to the previous level east of the Rockies (starting in July 1982 western producers offered contract customers 5% discounts from list price levels, a system that pertained into 1985). And prices didn't finally get above $500 until July 1984 when eastern mills went up to $535, although discounting from this level continued through the year and into 1985. The industry's chances of getting a $35 price increase in April 1985 were still a subject of debate in early 1985.

The picture in both important export grades, thus, was one of overcapacity and weak pricing, and the common consensus going into 1985 was that the situation would not change until demand caught up with supply worldwide.

DOMESTIC PRICING

Canadian prices generally track U.S. pricing activity. In July 1984, U.S. newsprint prices went up to $535/metric ton; at the same time Canadian customers saw their quotes go up to C$585. In 1985, when U.S. customers were facing an April 1 increase to $570, the price for Canadian customers was scheduled to rise to C$635.

Canadian mills enjoy a comfortable dominance of their domestic markets in the whole range of pulp, paper and board products, and that too helps them maintain adequate pricing. For example, in 1983, the major imported pulp and paper commodity was 196,000 metric tons of printing and writing papers, while no other single imported commodity exceeded the 49,000 tons of imported wrapping papers.

Thus, at a time (early 1981) when U.S. prices of printing/writing paper were near their cyclical peak, and coated No. 3 printing paper (60 lb in rolls) was going for $897/short ton, Canadian buyers were paying the equivalent of US$1,070, by one estimate. Canadian consumers were also paying an estimated US$30/short ton more for their 50-lb multiwall kraft sack than the $405 price in the U.S.

On the other hand, in January 1985 coated groundwood prices went up 5% to 6% in the U.S., to around $941/short ton for 34-lb offset rolls. In February of 1985, Canadian prices were set to rise also, by 6% to 7%, to just over C$1,100. Paper was in such short supply in Canada that there was no question of a failure in this move. But Canadian consumers also had no reason to complain about such prices: with a 76-cent Canadian dollar, that $1,100 price works out to less than US$840.

Historically, Canadian prices have not grown as rapidly for those products intended for domestic use as they have for many major export commodities. Between 1976 and 1983, however, the Statistics Canada domestic price index for fine/writing/reproduction paper rose by 59.4%—while U.S. transaction prices for representative uncoated free-sheet grades were up only about 30%. For corrugating board and linerboard, the Canadian index shot up by 76.4%, while U.S. linerboard and medium prices, again, were up by only about 30%. Canadian producers of those grades were able to pass along price hikes in their domestic market more than they could have done in the U.S.—although with the strong dollar they were able to get by with smaller U.S. price rises.

The StatCan price index for export newsprint shot up by 90%. But bleached sulfite pulp for export went up by just 38.8%, and unbleached sulfate for export grew just 40.6%. The index for export bleached sulfate pulp rose only 27.4%.

KEEPING AHEAD OF COSTS

Canadian government figures show that the value of shipments of Canadian pulp, paper and board mills rose by 1.8% in current dollars to C$10.8 billion in 1983 from 1982 levels. At this level it was actually down marginally from 1980. In constant dollars, shipments dropped. But since the inflation rates for Canada's trading partners were lower than the Canadian rate, that increase in current dollars went straight to the mills' bottom lines, at least for export sales.

Cost-control remained a crucial problem, however. Between 1974 and 1982, the value of shipments from Canadian mills rose by 86.7%, while in the same period the cost of materials and supplies shot up by 111%, according to Statistics Canada. Wages for production workers went up by 114.9%, the agency reports, and the cost of fuel and electricity mushroomed—rising by 234.6%, and spawning a new spirit of energy conservation in the industry (see related chapter).

MAJOR COST FACTORS

In the 1980s, the value of shipments has stagnated while costs have continued to rise. The industry's value of shipments in 1980 was C$10.9 billion and in 1982 it was only $10.65 billion. During that time, cost of materials and supplies increased by 5.7%, led by a 32.0% jump in fuel and electricity and a 16.1% rise in wages and salaries of production workers.

A variety of measures of mill operating costs exists, including government figures, those worked up for internal use by the Canadian Pulp & Paper Assn., and estimates prepared by consultants and analysts as varied as Sandwell & Co., *PaperTree Economics* and the *Canadian Paper Analyst*. They all disagree about the relative weight to attach to particular cost factors, but they tend to agree on one theme: cost increases in recent years have far outpaced price increases.

One estimate of newsprint cost increases, for example, made by Vancouver analyst Jaak Puusepp of Pemberton Securities, indicates that between 1979 and 1982, costs and expenses (including transportation) for British Columbia mills rose by 61.2%. The largest single reason for this dramatic increase was an 80.9% explosion of **wood costs,** along with a 67.5% rise in **wages.** But while costs were rising by more than 61%, PULP & PAPER WEEK estimates show list prices in the U.S. were going up by only 28.9%.

The kind of pressure this puts on pretax profit margins is obvious. Puusepp estimated the margin for the typical British Columbia newsprint mill would fall from 31% in 1979 to 16.8% in 1982—and he was writing before the failure of 1982 price increases became evident.

Not all cost factors rose by the same predictable and regular increments, as a comparison between 1976 cost estimates for British Columbia newsprint mills, made by the Canadian Dept. of Industry, Trade & Commerce, and the 1981 cost estimates by PULP & PAPER WEEK will show. **Energy** costs for British Columbia newsprint mills in 1976 averaged US$24/short ton, according to Ottawa; according to PULP & PAPER WEEK estimates, they had risen to $41 by 1981, a 70.8% rise. But during the same period, **transportation** costs for those mills rose on the average by only 32.3%, to $45/ton, while **labor** costs—including the lower labor intensity of recently installed equipment, plus other labor savings—rose by only 29.4%, to $66/ton.

But by PULP & PAPER WEEK's estimates, **wood** costs for those mills shot up by 50.8% between 1976 and 1981, reaching $92/ton. And in 1981 wood represented the largest single cost component in producing a ton of newsprint—26.4%, up slightly from the Canadian government's 1976 estimate of 25.6%.

Those dramatic cost increases were roughly duplicated in other sectors of the Canadian industry, as shown by StatCan figures comparing 1976 with 1982 (more recent figures are not available). StatCan figures indicate **pulpwood** costs for the entire Canadian pulp and paper industry rose by 47.8% between 1976 and 1980, and in 1982 represented 27.8% of the total cost of materials and supplies. **Wood residues** represented another 23.0% of the cost of materials and supplies in 1980, having risen by 94.6% from 1976. **Chemicals,** making up 16.1% of the industry's material and supplies budget, grew in cost by 82.1% during the same period.

One restraint on cost increases has been the decreasing **labor** intensity of the industry. Between 1976 and 1982, while shipments of pulp, paper and board were growing by 5.3% according to StatCan/CPPA figures, the number of employees declined by 4.7% to 83,000 and the number of workhours for production and related workers fell by 7.1%. Those trends are expected to continue as technology replaces less efficient machines with more efficient equipment.

Other important cost factors include **repair machinery, equipment** and **construction**, which rose 29.8% between 1980 and 1982 alone.

Future cost trends. Future costs are impossible to predict, of course, but recent labor settlements have been very moderate. Energy costs have been held down somewhat by the increased reliance on self-generated energy, while mills dependent on purchased fossil fuels found oil prices dropping in early 1985. The most important factor—the material that keeps the mills running—is fiber, and that is largely dependent on the state of the housing industry, a volatile and impossible-to-predict sector of the economy. Transportation cost increases have been moderate due to substantial overtonnaging in a number of ocean trade routes, and could be further restrained if railroad deregulation becomes a fact in Canada as it has in the U.S.

PROFITABILITY

Although slower to benefit from the North American economic recovery than their U.S. counterparts, most Canadian pulp and paper companies reported healthier earnings for 1983—particularly compared with the depressed performance of 1982. Indeed, it is fair to say that for some Canadian firms 1983 meant a big step back from the brink.

Major portions of the British Columbia industry, in particular, were effectively bankrupt in 1982, and were kept in operation strictly at the sufferance of their bankers. Red ink in the East was less plentiful than in the West, but even there the improvement in pulp and paper sales—and in lumber operations of many companies—was significant.

Hard times in British Columbia. Business was still not good in British Columbia. British Columbia Forest Products Ltd. lost almost C$33 million in 1983, although conditions improved as the year went along and fourth quarter 1983 losses were just $4.4 million. Its losses in the same period of 1982 had been almost five times as great. MacMillan Bloedel Ltd. actually got into the black in 1983, although it recorded net

CANADIAN PULP AND PAPER COMPANY SALES AND EARNINGS FOR 1983

(000 Canadian dollars)

	Sales	% change 1983/82	Earnings[1]	% change 1983/82
Abitibi-Price	C$1,660,180	1.6	C$ 38,013	-38.0[2]
B.C. Forest	889,700	12.6	(32,700)	n.m.
Canfor	995,100	36.4	(44,700)	n.m.
Con-Bathurst	1,393,000	-2.3	43,000	-19.5
Crown Forest	727,300	11.1	(17,200)	n.m.
Doman	175,400	34.2	(4,007)	n.m.[3]
Domtar	1,820,000	7.9	40,900	349.5
Donohue	357,900	13.5	9,400	-43.0
Great Lakes	494,981	13.0	(9,936)	n.m.
Mac. Bloedel	2,040,000	10.9	2,800	n.m.[3]
Rolland	229,700	36.3	8,333	n.m.[3]
Weldwood	586,153	41.2	9,568	n.m.[3]
Total	**11,379,414**	**11.2**	**51,485**	**n.m.[3]**

[1] Income after taxes, from continuing operations, excluding most significant nonrecurring items in both years.

n.m. = not meaningful.

[2] 1982 figure restated by company.

[3] Not meaningful due to loss in 1982.

( ) = Loss. n.m. = Not meaningful.

earnings of just $2.8 million on sales of $2.0 billion for the year.

The pulp market continued to be hard on everybody who participated in it in 1983. Great Lakes Forest Products Ltd., the biggest eastern money-loser in 1983, blamed pulp and lumber for its $9.9 million loss for the year. Canfor Corp. lost almost $45 million in 1983 despite a 36% rise in its sales from 1982 levels. Its fourth quarter loss alone was $16.8 million. With sales for the year of just under $1 billion, it was the largest Canadian company still in the red by the end of 1983. On the other hand, its losses for the year and the fourth quarter were about half what they had been in the comparable 1982 periods, and Canfor did produce a small operating profit in 1983.

Mixed profit picture. For eastern Canadian companies in general, solid increases in sales produced a mixed profit picture for the year as a whole. But the fourth quarter of 1983 produced massive increases in profits for several firms—1,282% in the case of Abitibi-Price Inc., 95.5% for Consolidated-Bathurst Inc., 60.5% for Donohue Inc., and 368% in the case of Rolland Inc. Con-Bath attributed its fourth quarter showing to cost-reduction efforts and better results in bleached pulp. Domtar Inc. recorded profits that could not be compared meaningfully to 1982 figures because it lost money in the fourth period of 1982.

For the 12 major Canadian companies as a group, profits for full-year 1983 of $51.5 million contrasted with 1982 losses totalling $184.4 million. Sales were up 11.2% year-to-year. Fourth quarter performance for the group also improved, with firms reporting earnings of $45.0 million compared with losses of $93 million in the same months of 1982.

Weakness in prices. Earnings would have been greater in 1983 if it hadn't been for the general weakness in that year of prices for Canada's major export commodities, market pulp and newsprint. Northern bleached softwood kraft pulp, for example, ended 1983 at $440/metric ton (delivered in U.S.), right where it had been at the end of 1982. But the average price for 1983 was only $435, compared with $494 in 1982. And that year was down from the average price of $534 in 1981.

In newsprint, also, the average price for paper delivered to the U.S. (East Coast) dropped from the average of 1982. The average for 1982 was $496/metric ton, which fell to $468 in 1983. The trend in 1983 was up, however, with prices dropping by 6% during the fourth quarter of 1982, from $500 to $468.50, and then returning to $500 in the third quarter of 1983.

Good news in 1984. Finally in 1984 the news turned good for almost all Canadian companies. Based on the performance in the third period of 1984 for 11 Canadian companies, sales rose 17% and earnings shot up by 203.7%. Only three companies lost money in the third period: Canfor ($5.4 million), Fraser Inc. ($2.9 million) and Weldwood of Canada Ltd. ($2.5 million). Fraser's losses were brought on by startup costs associated with modernization of its Atholville, N.B., market pulp mill.

Abitibi's earnings jumped 71.2% to $15.3 million, and MacMillan Bloedel earned $7.5 million—an increase of 1,150% from the third quarter of 1983. Other increases included 166.7% for Con-Bath, 39.5% for Domtar and 172.0% for Donohue.

Other figures, for BCFP, Canfor, Fraser, GLFP and Weldwood, were not comparable because of losses in the year-earlier period. Only Rolland saw earnings drop, by 53.4% to $1.4 million on sales of $70.7 million.

Performances of eastern Canadian firms continued to outstrip western companies' records, based largely on heavy dependence of the western firms on market pulp and lumber. Con-Bath's healthy rise was restrained somewhat by a long strike at its Port Alfred, Que., newsprint mill and losses connected with startup of a new newsprint mill in the U.K.

Weak Canadian dollar. Although some Canadian firms don't like to say it too loudly, one of the reasons for improved profits in 1984 was the impressive fall in value of the Canadian dollar vs the U.S. currency. The Canadian dollar spent most of 1984 below US$0.80, and averaged just over US$0.76 in the third period of 1984. By contrast, the average value for 1982 and 1983 was about US$0.81, and in earlier years it had been higher still (see table in Canadian Production, Exports/Imports chapter).

And with most of its output sold in U.S. dollars, this means unearned profits for the Canadian industry. Unfortunately for the long-term financial outlook of the industry, this kind of earning is difficult to predict and impossible to guarantee.

CAPACITY EXPANSION

Capacity expansion will be minimal in Canada in the 1983-86 period, with only groundwood specialties and book and printing papers showing rapid growth. As a result, total Canadian paper and board capacity is expected to rise just 1.3% in 1984, 1.8% in 1985 and 0.3% in 1986, according to the Canadian Pulp & Paper Assn.'s annual capacity survey, released in mid-1984. The survey also shows market pulp capacity going up 2.5% in 1984, edging down 0.1% in 1985 and heading back up by 1.3% in 1986.

The fastest growth rate expected for the entire Canadian industry—excluding the continued trend toward thermomechanical pulp at newsprint mills—is in printing and writing papers, with annual rises of 5.7% forecasted. By contrast, "other paper" should go up just 1.5%/yr and containerboard and boxboard an average of 2.0%/yr each.

These rates are actually higher than the 1973-83 average, with printing and writings having gone up 5.3%/yr in the last decade, other paper just 0.9%/yr, containerboard 1.3%/yr, and boxboard 1.6%/yr. But the growth rate for Canadian industry overall is held below the trend of the last 10 years by the flat newsprint number (compared with a 0.9%/yr growth rate in 1973-83) and the unchanged building paper and board figure (coming off a 0.5%/yr record over the last decade).

British Columbia's recent leadership in capacity expansion has evaporated. In the 1983 survey, CPPA forecasted a 6.8% total growth in the province's pulp capacity in the 1982-85 period, for example, down from 14.9% in the previous survey. In the 1984 survey, the rise was pared to just 3.4% for 1983-86, compared with 3.7% for Ontario, 6.2% for the Atlantic provinces, 2.5% in Quebec and 1.8% in the prairies.

In paper and board also, British Columbia was seen rising just 0.3% compared with 14.5% in the 1983 survey and 25.7% in the 1982 estimate. In contrast, Ontario's capacity should rise 7.4% in 1983-86, Quebec 2.6%, and the Atlantic provinces 2.6%, while no change is seen in the prairie provinces.

Newsprint. Newsprint capacity will fluctuate within a 65,000-metric-ton range during the period ending 1986 at the same 9.97 [illegible]lion-ton level as it began the period in 1983. Machine shutdowns and upgrades to groundwood specialties should exactly offset machine replacements and modernizations.

Groundwood specialties. Conversion of newsprint machines to uncoated groundwood at three mills will boost capacity for these grades by 20.5%, or 160,000 tons, during the survey period. The three mills are Abitibi-Price Inc.'s Beaupré, Que., facility, MacMillan Bloedel Ltd.'s Port Alberni, B.C., mill, and St. Raymond Paper Co. 1983 Inc., at Chute Panet, Que.

Book/writing, sanitary papers. An even larger increase is represented by book and writing papers, although this represents a smaller percentage rise since it's from a higher base. Book and writing capacity will rise by 172,000 tons, or 16.8%, as a result of new machines at Great Lakes Forest Products Ltd.'s Dryden, Ont., mill and Island Paper Mills Ltd.'s New Westminster, B.C., unit. In the sanitary paper area, capacity will rise by 8.5%, or 38,000 tons, due to increases at Atlantic Packaging Products Ltd.'s Toronto unit and Scott Paper Ltd.'s New Westminster mill.

Paperboard. Miscellaneous improvements will be responsible for the 11.4% increase, to 361,000 tons, for folding boxboard (excluding solid bleached). Recycled corrugating medium capacity is expected to rise by 27.4%, or 32,000 tons, while recycled liner goes up 5.6%, or 16,000 tons, and kraft liner rises 5.2%, or 45,000 tons.

Total pulp. Pulp capacity for all grades should rise by 3.5% to 24.2 million tpy by the end of 1986, maintaining the growth rate of the last decade. Expansions at E.B. Eddy Forest Products Ltd.'s Espanola, Ont., mill, at Northwood Pulp & Timber Ltd.'s Prince George, B.C., mill and Western Pulp Partnership Ltd.'s Squamish, B.C., facility account for the planned increase in bleached kraft pulp. Rebuild of Fraser Inc.'s Atholville, N.B., mill is boosting bleached sulfite, while expansions at Tembec Inc.'s Temiscaming, Que., installation and Western Pulp's Port Alice, B.C., mill will increase dissolving/special alpha.

Market pulp. Market pulp capacity will rise just 284,000 tons during the 1983-86 period, to 7.9 million tpy, and 109,000 tons of that increase will come from mechanical pulp. [The mechanical pulp rise is deceptive, however, since it reflects the conversion of Consolidated-Bathurst Inc.'s Bathurst, N.B., mill early in the period from chemical to thermomechanical pulp—even though the resulting pulp is intended for shipment to C-B's Bridgewater newsprint mill in the U.K.]

Paper-grade sulfate market pulp capacity will rise just 138,000 tons, or 2.1%, during the period. The 0.7%/yr rate this implies is just a quarter of the 1973-83 pace. However, bleached softwood kraft is rising by 196,000 tons, or 3.8% over the period, due to conversions by several mills from bleached hardwood. This reverses a trend from 1983. The increase in softwood kraft is partially offset by a drop in semi-bleached softwood as well as in bleached hardwood.

CANADIAN INDUSTRY ANNUAL CAPACITY GROWTH, 1983-86

(000 metric tons)

	1986	1985	1984	1983
Market pulp				
Dissolving & special alpha	227	222	214	201
Sulfite paper grades	389	387	354	378
Sulfate paper grades	6,782	6,690	6,740	6,644
Bleached softwood	5,399	5,257	5,275	5,203
Semibleached softwood	441	443	446	453
Bleached hardwood	717	765	799	780
Unbleached	225	225	220	208
Total chemical paper grades[1]	**7,171**	**7,077**	**7,094**	**7,022**
Increase from previous year	94	−17	72	182
	1.3%	−0.2%	1.0%	2.7%
Mechanical	527	527	527	418
Total market pulp capacity	**7,925**	**7,826**	**7,835**	**7,641**
Increase from previous year	99	−9	194	24
	1.3%	0.1%	2.5%	0.3%
Paper and board				
Newsprint	9,970	10,000	9,935	9,970
Groundwood printing	960	935	840	800
Book, writing & misc.	1,198	1,182	1,118	1,026
Kraft papers	564	558	555	554
Special papers	37	37	37	37
Containerboard	1,905	1,894	1,870	1,794
Boxboard	814	800	787	767
Total (excl. bldg. & other)	**15,935**	**15,891**	**15,603**	**15,397**
Building & other	752	751	750	751
Total paper & board capacity	**16,687**	**16,642**	**16,353**	**16,148**
Increase from previous year	43	289	205	112
	0.3%	1.8%	1.3%	0.7%

1. Excluding dissolving and special alpha.

Source: Canadian Pulp & Paper Assn.

CAPITAL SPENDING

Canadian pulp and paper companies slashed expenditures on nonessential items to the bone during the back-to-back recessions of the early 1980s, their actions culminating in 1983 when they cut capital budgets by 37% to C$1.06 billion, according to Statistics Canada.

But StatsCan's mid-year review in 1984 found that spending plans for the current year had been boosted to C$1.27 billion—a 19.8% increase from 1983, compared with the 2.8% increase that had originally been indicated in the agency's February 1984 review.

A *Pulp & Paper* survey in late 1983 found that Canadian companies planned to spend $4.7 billion through 1989. This figure was boosted from a very low preliminary estimate of less than $3.6 billion (lowest since 1980) when two companies—Domtar Inc. and Western Forest Products Ltd.—announced major programs that added $1.2 billion to the total. These two programs were exceptional in size in the Canadian industry, but even so, they did symbolize the thawing of a virtual capital budget freeze that began in 1982.

Biggest spenders. The survey found 11 companies which planned to spend $100 million or more in the 1983-89 period, led off by Domtar's big $773 million Windsor, Que., upgrade and a companion $139 million modernization of its Cornwall, Ont., mill—bringing Domtar's total outlay to well over $1.0 billion. Other top spenders included Consolidated-Bathurst, $544 million; Great Lakes Forest Products, $384 million; E.B. Eddy Forest Products, $321 million; and Abitibi-Price, $299 million.

A late-1983 *Pulp & Paper* estimate, made before the Domtar and WFP announcements, found that pulping headed the list of expenditures planned for 1983-85 (including previously announced projects for 1986 and beyond) representing 35% or more of planned outlays. The major change found in the current economic cycle from past years, however, is in the kind of expenditures companies are making on paper machines: rebuilds and modifications of existing machines have clearly replaced new units as the major source of expenditures. In the late-1983 survey, machine modifications represented 14% of total spending plans compared to just 5% in the previous year's survey, while new machines fell to 5% from 12% in the 1983 tally.

Increase in construction. StatsCan found that the biggest change in companies' spending plans as the economic recovery unrolled was in the area of construction outlays. By mid-1984 companies planned to lay out $151.5 million during the year for construction, up 15.6% from the year earlier—compared with a 16.6% drop in the early-1984 survey. Spending for new machinery and equipment in 1984 was expected to rise 20.4% from 1983, to $1.12 billion, compared with an increase of only 5.2% in the earlier survey.

By province, StatsCan saw capital outlays for 1984 rising by 23.9% to $526.9 million in Quebec, 21.2% to $308.9 million in Ontario and 105.9% to $243.2 million in British Columbia. In the previous survey British Columbia mills had planned expenditure increases of just 7.4%, to $126.8 million. Healthy as the revised British Columbia figure is, it does not compare with the province's 1982 pace of $366.1 million.

Repair expenditures. In addition to planned capital improvements, StatsCan also tracks spending on repair and maintenance. Planned repair outlays for 1984 were estimated to be $1.0 billion, up 9.9% from 1983.

TOP SPENDERS IN CANADIAN INDUSTRY*

(C$000)

	1983-85	1982-84
Domtar Inc.	C$1,012	214
Consolidated-Bathurst Inc.	544	372
Great Lakes Forest Products Ltd.	384	380
E.B. Eddy Forest Products Ltd.	321	299
Abitibi-Price Inc.	299	345
Maclaren Industries Inc.	255	104
Western Pulp Ltd. Partnership	248	—
CIP Inc.	211	209
Fraser Inc.	170	228
Ontario Paper Co. Ltd.	145	346
Reed Paper Ltd.	120	120

* Includes programs for completion beyond 3-year period indicated.

Note: All totals include production and environmental programs.

MERGERS AND ACQUISITIONS

Takeover and merger activity in Canada was altered dramatically by the recessionary and high interest rate environment of 1982. What had been an "asset grab and takeover frenzy" (in the words of McLeod Young Weir Ltd. analyst James Robb) in 1981 virtually died out in 1982 and then returned to saner, more normal patterns in subsequent years.

Indeed, very little happened in 1982-84 that resembled the hectic activity of 1978-81. The earlier period included such dramatic events as the takeover of Canada's two largest pulp and paper companies—MacMillan Bloedel Ltd. and Abitibi-Price Inc.—plus the sale of CIP Inc. to Canadian Pacific Enterprises Ltd. by American parent International Paper Co., purchase of a controlling interest in Noranda Mines Ltd. (acquirer of MB) by Brascade Resources, and the disastrous purchase of ITT Rayonier Inc.'s Canadian assets by British Columbia Forest Products Ltd., Doman Industries and Whonnock Industries.

Before being taken over by Noranda, MB had tried a little empire-building of its own, when it and Domtar Inc. traded acquisition bids with each other. MB had also reportedly been thinking about taking a run at Abitibi, which was eventually purchased by real estate developers Olympia & York Developments Ltd., following a noisy three-way donneybrook that also involved a shipping company and a major publisher.

Only three major developments. But when money became expensive and profits scarce, executives began taking care of business closer to home and the merger mania disappeared. Indeed, in the 1982-84 period only three really major ownership changes took place: the purchase of Crown Zellerbach Corp.'s Canadian subsidiary by Fletcher Challenge Ltd. of New Zealand, sale of bankrupt Western Forest Products Ltd.'s two mills to a novel limited partnership group, and spin-off to the public by Bowater Corp. of its North American assets.

Two of the three were actually continuations of activities that began publically in the prior round of takeovers. CZ had expressed an interest in getting out of Canada, but it began its search for a buyer right at the end of the "takeover frenzy," and could not conclude a satisfactory sale before conditions turned sour.

And the Western Forest deal represented an attempt by the three general partners and their bankers to rescue the joint venture from a disaster compounded of excessive debt and financing costs involved in purchasing the mills in 1980, poor markets for some products, inefficient facilities and the high anticipated cost of modernization programs.

Fairly conventional sales. Most of the remainder of the significant takeovers in 1982-84 represented fairly conventional changes of ownership: private firms going public (Tembec Inc.), companies purchasing unwanted assets from other firms (Marathon, East Angus, Newcastle, Sault Ste. Marie, Jonquière, Corner Brook, Kingsey Falls and potentially Tahsis) and employees buying their own mill to prevent shutdown or unwanted takeover (Perkins Paper Ltd.).

Only the Fraser Inc. purchase of 50% of Island Paper Mills Ltd. was a little different—and it was also related to the previous round of takeovers. In this case, a Noranda company, Fraser, stepped in to help give a company acquired by Noranda in 1981, MB, a needed cash infusion by purchasing part of an MB-owned mill. The move also made sense from the marketing point of view, in at least one way: it made Fraser the only Canadian company with truly nationwide activities in printing/writing papers.

Not all of the takeovers of the last round turned sour. Canadian Pacific came in for a lot of criticism for its purchase of IP's Canadian mills. But by late 1984 it began to appear that CIP may eventually become a healthy and respectable part of the CP group after all. And Olympia & York's purchase of Abitibi, while it did not prove to be a gold mine for the real estate developers, did bring them a source of cash flow in the unsteady real estate markets of the 1980s. And the Quebec government is undoubtedly happy that it took control of well-run and profitable Domtar.

No return to "mania" seen. As for the future, it appears unlikely Canada will see a return to merger mania in the next few years. Eastern Canadian companies were profitable in 1984 and British Columbia firms were climbing slowly out of the red. But most executives in the industry seemed more concerned with finding cash for modernization and efficiency improvements than for empire-building. Until Canada's banking system is once again flush with extra money, that situation seems unlikely to change much.

MAJOR CANADIAN PAPER INDUSTRY ACQUISITIONS

Acquiring company	Paper company acquired	Estimated value (C$ million)	Year
Fraser Inc.	50% of Island Paper Mills at New Westminster, B.C.	C$ 25	1983
Fletcher Challenge Ltd.[1]	Crown Zellerbach Canada (since renamed Crown Forest Industries), mill at Campbell River, B.C.	242	1983
Western Pulp Limited Partnership[2]	Western Forest Products' Port Alice & Squamish, B.C., mills	150	1983
James River Corp. & Buchanan For. Prod.	Marathon, Ont., mill of American Can	10.5	1983
CIP Inc.[4]	CIP signed option to acquire the 50% of Tahsis Co., Gold River, B.C., it does not already own, from EAC	n.a.	1983
Cascades Inc.	East Angus, Que., mill of Domtar	n.a.	1983
Employees and outside investors	Group put together to buy Perkins Papers Ltd. at Candiac, Que., from Bowater	n.a.	1983
Repap Enterprises[5]	Boise Cascade Canada Ltd.'s Newcastle, N.B., pulp mill	90	1984
St. Marys Paper Inc.	Sault Ste. Marie, Ont., mill of Abitibi-Price	n.a.	1984
Cascades Inc.	Jonquière, Que., mill of Abitibi	n.a.	1984
Public[6]	North American assets of Bowater Corp. spun off to public; new U.S.-based firm required to pay U.S. $57 million for Bowater Canadian Ltd.	132	1984
Kruger Inc.	Bowater Inc.'s Corner Brook, Nfld., mill	n.a.	1984
Public	Tembec Inc. went public, with public getting 31% of firm	n.a.	1984
Cascades Inc.	Manville Corp. of U.S.'s 50% share of Papier Kingsey Falls mill; balance already held by Cascades	1.2	1984

n.a. = Not available.

1. In addition to the purchase of CZ Canada—in which Fletcher Challenge actually acquired only 96% of shares, the balance remaining in public hands—FC also get a small shipping subsidiary as part of the deal. Amount is given in US$.
2. Partnership consists of limited partnership units sold to public in an offering that produced a yield of C$101 million. Dollar amount given above for sale represents debenture offered to Western Forest Products by Partnership.
3. Jame River acquired 80% of mill and Buchanan 20%.
4. The five-year option signed by CIP started running in 1983.
5. Purchase agreed to in 1984 but closure of deal postponed into 1985. Dollar amount is given in US$.
6. Bowater Corp. offered 25% of shares of Bowater Inc., the North American operations, on North American stock exchanges. The remaining shares were to be distributed on pro[illegible]ata basis to Bowater Corp. shareholders. Dollar amount given above is in US$, and refers to yield of initial public stock offering.

LABOR

Payroll costs in the Canadian pulp and paper industry are among the steepest in the world, second only to those in some sections of the U.S.

The base hourly wage in the Canadian forest products industry in 1984 ranged from C$13.48 on the West Coast to $12.83 in eastern Canada. The latter figure is based on a settlement reached in mid-1984 between Abitibi-Price Inc. and the Canadian Paperworkers Union. That three-year agreement was expected to be the basis for settlement with other companies in the region by year-end. The Abitibi contract called for the base wage to increase to $12.83 in 1984, $13.34 in 1985, and $14.01 in 1986.

When West Coast contracts come up for renewal again in 1986, the base wage will be $14.08. By contrast, the base hourly pay in the highest paid region of the U.S. pulp and paper industry—the West—in 1984 was US$11.05, according to the American Paper Institute, equivalent at July 1984 exchange rates to about C$14.59.

Canadian pulp and paper industry payroll costs continued to increase at an annual rate of about $150 million late in the 1970s, while the number employed in the industry continued to decline by about 2,000 yearly, due to improved technology. A brief turnaround came in 1981, when the employee count rose by about 1,000, with a comparable increase in payroll costs, according to Canadian Pulp & Paper Assn. statistics. In 1982, however, employment once again plummeted, dropping by more than 4,000.

Bargaining pattern. Unions in the Canadian pulp and paper industry tend to wield more power in bargaining than their U.S. counterparts because of a highly centralized bargaining pattern, as well as some pro-labor government policies, such as one prohibiting companies from operating mills during walkouts.

The bargaining focus in Canada alternates between the East and West. Until 1984, both regions tended to negotiate two-year contracts expiring in the West in odd years and in the East in even years. In 1984, however, both regions approved three-year contracts, with the West's agreement (bargained jointly by most mills) expiring in 1986, and most contracts in the East lapsing in 1987.

Only a few companies vary from this pattern. These have contracts of one-, two-, or four-year duration, or three-year contracts expiring in years when the rest of the region's companies are not bargaining.

On the West Coast, most companies belong to bargaining groups called Forest Industrial Relations Ltd. and the Pulp & Paper Industrial Relations Bureau, which act as industry-wide bargaining agents. The former group bargains for the timber sector of the industry, while the latter handles paper industry negotiations. In eastern Canada, the industry does not bargain collectively except for four companies. These are Domtar Inc., Reed Inc., Q.N.S. Paper Co., and James Maclaren Industries Inc., which refer to their

CANADIAN PULP & PAPER MILLS EMPLOYMENT AND EARNINGS

Year	Average number employees	Average weekly payroll (000)	Average weekly earnings
1982	77,798	C$42,558	C$574
1981	83,224	41,758	502
1980	82,104	35,944	438
1979	83,458	33,277	399
1978	82,239	30,243	368
1977	81,702	27,943	342
1976	79,182	24,762	313
1975	68,885	18,590	272
1974	80,653	19,112	237
1973	73,763	15,209	206
1972	73,829	14,247	193
1971	74,636	13,255	178

Source: Canadian Pulp & Paper Assn.

consortium as the Eastern Canadian Newsprint Group.

Canadian unions. The largest union in the Canadian pulp and paper industry is the Canadian Paperworkers Union, which has 60,000 members throughout Canada, with 45,000 in eastern Canada. Of that national total, 40,000 are employed in primary mills, 13,000 in the converting sector, 5,000 in forestry operations and 2,000 in office work. About 30,000 of the CPU's primary sector members are in the East and 10,000 in the West.

Other unions include United Paperworkers International Union, which has only 2,500 members in Canada. The bulk of its support is in the U.S., where it has 266,000 members. The CPU broke off from the UPIU in the 1970s. Another major Canadian union, Pulp & Paper Workers of Canada, has about 7,500 members, most of them in British Columbia.

Traditionally, Canadian unions have tended to stage prolonged strikes, ranging from several weeks to several months, in order to attain contract demands. In 1981, a six-week strike by 60,000 members of CPU, PPWC, and International Woodworkers of America (consisting mostly of timberland and sawmill workers) shut down the entire British Columbia forest products industry. The strike cost companies an estimated C$18 million/day in sales revenue while employees lost in excess of $8 million/day in earnings.

In the 40 years prior to 1981, the West Coast had been hit by five other industry-wide strikes. Two of these were staged by pulp and paper unions and lasted three months each. The IWA has gone out an additional three times, with the longest strike lasting 70 days and the shortest 36 days.

In eastern Canada, the industry's unions have usually targeted a major company with which to work out a labor contract and then have used this as a pattern in negotiations with other companies bargaining that same year. Abitibi-Price, the largest paper company in eastern Canada, is the unions' most frequent target. In 1975, Abitibi mills were closed during a seven-month strike by the CPU. In 1980, the union again struck Abitibi, but this time for only five weeks. That same year, Domtar mills were struck for seven months.

In 1982-83, however, unions were forced to rethink their tactics as company bargaining clout increased due to the mounting need to curtail costs. In 1984, after nearly a year of bargaining and little progress toward reaching an agreement, the British Columbia industry locked out the unions for two months, proving it was more willing to take downtime than sign a high-cost contract. The government eventually had to intercede, and a three-year contract was later signed that provided for a one-year wage freeze and pay hikes of only 4%/4.5% over the last two years.

At about the same time British Columbia's unions were ratifying their contract, eastern Canadian bargaining was beginning. Realizing the West Coast settlement would impede any labor grandstanding in the East, CPU leaders were modest in their demands compared to previous years. By summertime, the CPU and Abitibi had reached an agreement, without any labor problems, calling for pay hikes of 2.5%/4%/5% over three years.

The eastern Canadian industry suffered only two strikes during the first three quarters of 1984. One was a CPU walkout at Domtar's Lebel-sur-Quevillon, Que., mill, and the other was a Confederation of National Trade Unions' strike at Consolidated-Bathurst Ltd.'s Port Alfred mill in Ville-de-la-Baie, Que.

Labor's more amenable approach to bargaining actually began in 1982. The target that year, Abitibi, began to inform its employees as the year progressed that its earnings were deteriorating as the recession progressed. Communicating with its employees paid off when talks were concluded without a strike, and union members voted to accept a two-year contract calling for wage increases of 12% the first year and 10% the second year, despite recommendations from CPU leaders to reject the offer. The CPU initially sought wage increases of 40% over a two-year period and later reduced its demand to a minimum of 28% in an attempt to at least

CANADIAN PAPER WORKERS UNIONS

Union	Region represented	No. of members	No. in primary pulp and paper
United Paperworkers International Union	Canada	2,300	not available
Canadian Paperworkers Union	Canada	60,000	40,000
	(West)	15,000	not available
	(East)	45,000	not available
Pulp & Paper Workers	Western Canada	5,500	4,000

Pulp and paper workers are also represented in Canada by such major unions as the Confederation of National Trade Unions, International Assn. of Machinists & Aerospace Workers, International Brotherhood of Electrical Workers, and others.

reach parity with wages paid to West Coast workers.

Just a year earlier, the CPU had succeeded in forcing an agreement in the East which was especially burdensome to the industry. The 1981-83 contract called for a 15% wage hike in the first year and a 13% increase in the second. When the economy weakened and earnings began to plummet, companies asked unions to freeze wages for six months, but the request was turned down. At the time, unemployment in sawmills reached 25%.

As 1984 drew to a close, unions began to feel that 1985 and 1986 might be better years for improving workers' wages and benefits; but for 1984, agreements were still modest and most companies in eastern Canada were expected to follow the Abitibi settlement pattern. A number of companies, however, were resisting the pension plan included in Abitibi's contract. That plan was negotiated in 1982 and includes indexing of payments to inflation to a maximum of 5% a year.

Bargaining outlook. With unions in both regions of the country having ratified three-year agreements at most companies, bargaining in 1985 should be extremely light. Only a few mills which ratified longer or shorter agreements or three-year contracts in different, earlier, years will be negotiating. Contracts at most mills in British Columbia are due to expire in 1986, and in eastern Canada in 1987.

With relatively light agendas in 1985, unions should have time to contemplate various policy-related issues such as possible mergers with other unions, a concern which has mounted in the face of declining membership caused by the industry's modernization and the closure of older, less efficient mills. In 1982, the CPU nearly merged with the Energy and Chemical Workers Union, but the move was turned down by members in a close vote. There were signs late in 1984 that the union was again considering merging with another union.

Light bargaining will also enable companies to concentrate more of their efforts on such concerns as capital improvements, research and development, labor relations, and production.

TIMBER RESOURCES, PULPWOOD CONSUMPTION

Canadian pulp and paper mills spent C$2.4 billion in 1982 to buy roundwood, wood chips and wood residues for pulping. This expenditure level closely parallels the 1980 spending figure of $2.3 billion, despite the business downturn suffered by the Canadian pulp and paper industry in fiscal year 1982.

Companies harvest from a vast and rich national forestland that extends over about 2.2 million km^2 (849,200 square miles) in 10 provinces. If currently nonproductive forestland were included in Canada's potential forest resource, the figure would be closer to 3.42 million km^2 (1,320,120 square miles. The overwhelming volume of the active forestland is owned by the provincial governments, which control 80% of the total. The balance is held by the federal government (11.5%) and private landowners (8%). The largest landholders among pulp and paper companies are MacMillan Bloedel Ltd., Abitibi-Price Inc. and Domtar Inc.

Timber reserve dwindling. The timber ownership system in Canada is a highly convoluted combination of tree farm licenses, forest licenses, timber sale licenses, timber licenses, ownership in fee, and so on. The various licenses listed above are, in effect, rights to cut standing timber on land held by the Crown and represent the dominant form of timber control in Canada.

Despite the longstanding tenure held by many companies in particular blocks of land, these licenses no longer imply longevity. In fact, companies are finding provincial governments increasingly willing to turn timberland over to "new owners" if the old users of the land fail to reforest vigorously. And since the late 1970s, when work by Les Reed of the Canadian Forestry Service and others revealed that Canada's economically available timber reserve was rapidly approaching zero, governments and companies have launched aggressive programs to build new roads and plant new trees.

This near "revolution" in Canadian forest management awareness experienced a setback during the recession of 1982, however, when companies were forced to forego expenditures on regeneration activities. While the momentum toward active protection of forestry resources has returned, considerable concern remains regarding the future of timber reserves and of the Canadian pulp and paper industry. The general consensus is that softwood reserves of the Atlantic region have been fully allocated and, according to Bayard Palmer of Woodbridge, Reed Inc., a leading Vancouver, B.C., consulting company, they are being overcut by as much as 50% in some management units.

This figure could rise if efforts to halt the spruce budworm meet with only limited success. Whether intensive forest management programs can repair the situation in the long term is therefore still unclear.

Budworm infestation. A problem also exists in terms of the quality of available timber. The spruce budworm has caused severe problems in New Brunswick, New-

CANADIAN PULPWOOD CONSUMPTION

(000 cunits)[1]

	Roundwood	Wood residue	Total
1982	13,902	13,220	27,122
1981	15,970	14,167	30,137
1980	15,956	14,756	30,712
1979	15,860	14,498	30,358
1978	15,476	13,275	28,751
1977	14,845	11,975	26,820
1976	14,852	12,304	27,156
1975	13,950	8,495	22,445
1974	17,960	10,701	28,661
1973	16,879	9,883	26,762
1972	16,427	8,437	24,864
1971	15,978	7,405	23,383
1970	17,070	6,140	23,211

1. Cunit is 100 ft^3 of solid wood, excluding bark.

Source: Canadian Pulp & Paper Assn.

foundland and Nova Scotia, for example. And while a potential exists for hardwood development, particularly in Quebec, the quality of such reserves is dubious.

Long-term prospects are not entirely glum, however. An expansion of reserves can be anticipated in Atlantic Canada, where research has indicated that growth rates now being realized are far below the potential rate of growth. There are surpluses of timber in the North and the coastal region of British Columbia, but this timber is located far from existing markets and industry and costs may be too high to permit economic extraction.

According to analysts of the Canadian forest products industry, *current* levels of total harvest yield can be sustained without significant effort on the part of industry or government. However, some relocation may be necessary to areas of greater potential and minimal expenditures in order to maintain the existing total harvest yield. The province of Alberta holds greatest promise for long-term development, and there could be a considerable increase in pulp production there. Three new greenfield chemi-thermomechanical pulp mills, which have a higher pulping yield than chemical pulp mills, are expected to be built in British Columbia in the next 5 to 10 years.

Industry restructure. A restructuring of the pulp and paper industry, particularly on the western coast, can be anticipated as firms adjust to dealing with tighter supplies of materials. Some paper companies may expand into lumber in order to assure themselves of low-cost raw material. More emphasis is expected to be placed on local production of higher quality paper and paperboard—for example, printing and writing papers as opposed to basic newsprint or export of market pulp.

Future construction of new mills in most provinces will likely depend, therefore, on higher end-product prices to make it economical to harvest distant and isolated remaining stands, or on the coming-of-age of mechanical pulping processes that can use hardwood for producing top-quality value-added paper products.

PULPWOOD AND WOOD RESIDUE CONSUMPTION BY CANADIAN MILLS, 1982

(000 cunits)

Pulp process	Softwood roundwood	Hardwood roundwood	Woodchips	Other wood residues	Total
Mechanical	5,996	n.a.	779	54	689
Sulfite	1,696	n.a.	1,357	n.a.	3,053
Sulfate and soda	4,843	1,367	9,797	1,233	17,240
Total	12,535	1,367	11,933	1,287	27,122
Value (C$ millions)	1,244	106	1,072	47	2,469

n.a. = Not available; withheld by StatsCan to protect confidentiality of companies, and included within figures for other pulping processes.

Source: Statistics Canada.

ENERGY USE AND CONSERVATION

The Canadian pulp and paper industry reduced its purchased energy consumption by 25.3% as of 1983 (calculated against base year 1972). This figure is in marked contrast to the results reported at year-end 1981 and 1982, when the figures were 17.2% and 17.0%, respectively.

The drop reflects sluggish productivity during the recent recession rather than improved energy efficiency, however. Indeed, energy conservation efforts suffered throughout this slow business period as firms opted to postpone "nonessential" expenditures on items such as energy conservation.

While movement toward the industry's voluntary goal of reducing energy purchases 30% by the end of 1984 has been delayed, the industry is back on track in terms of pursuing economic energy alternatives, observers say.

Government pressure to conserve energy is not the only reason behind this desire to improve energy efficiency. In 1973 the cost of fuel and electricity for the industry rose by 10.7%—and then in 1974 it exploded, going up 51.2% in a single year. The total increase from 1972 to 1980 was 324%, according to Statistics Canada.

While the rate of price increases for purchased fuel and electricity has slowed in Canada, energy costs are still escalating. Despite the slow operating rates experienced by pulp and paper companies in 1982, the industry's energy bill during that year totalled $1.369 billion—up from $1.240 billion in 1981. This figure

CANADIAN PAPER INDUSTRY PURCHASED FUEL AND ENERGY, 1981 & 1982

(C$000)

Energy source	1981	% of total value of shipments	1982	% of total value of shipments
Coal and coke	11,845	0.1 %	16,558	0.15%
Natural gas	225,299	2.0	260,963	2.4
Gasoline	3,067	0.03	3,467	0.03
Kerosene	2,055	0.02	1,299	0.01
Diesel oil	10,338	0.09	11,946	0.1
Light fuel (Nos. 2, 3)	11,741	0.1	7,137	0.07
Heavy fuel (Nos. 4,5,6)	421,867	3.7	440,010	4.1
Liquified petroleum gases	6,936	0.06	7,169	0.06
Electricity purchased	493,387	4.3	558,656	5.3
Other fuel (including steam purchased)	53,289	0.4	61,913	0.6
Total fuel & electricity	1,239,825	10.7	1,369,118	12.9

Source: Statistics Canada.

represented 12.7% of the value of production in 1982. Purchased energy and fuel represented only 7% of the total cost of production as recently as 1979.

The dramatic climb in energy costs since the mid-1970s has led most mills to explore virtually every economically feasible avenue for reducing the amount of purchased energy needed to manufacture a ton of product. For example, there has been a significant increase in the amount of wood refuse that is being used as fuel. This substitution of wood refuse has resulted in a 50% reduction since 1973 in purchases of heavy fuel oils. Other options have included improving the press and dryer sections, installing heat recovery devices, and developing boilers that permit the burning of forest byproducts. By 1982, mills were already generating almost half their own energy through hogged fuel boilers, black liquor boilers and the like.

The largest portion of the industry's 1982 energy bill consisted of C$559 million spent on electricity (up from $493 million in 1981 and $426 million in 1980), reflecting Canada's emphasis on producing newsprint and groundwood paper made from mechanical pulp. Another $440 million was spent on heavy fuel oil ($421 million in 1981) and $260 million on natural gas ($225 million in 1981) with the balance going for coal and other fuels.

Pulp & Paper estimates indicate that, at the beginning of 1984, Canadian mills had budgeted $361 million for energy- and power-related capital projects in the 1983-85 period, including those projects already announced for 1986. That equalled about 11.4% of all planned capital expenditures. Of the energy and power projects originally planned for the 1983-86 period, 44% were to be in the Maritime Provinces, 35% in Quebec, 14% in Ontario, and 5% in the western region.

CANADIAN PAPER INDUSTRY ENERGY COSTS, 1972-84

(C$/metric ton of product)

	1984e	1977	1974	1972
Electricity	26.60	12.58	6.80	5.65
Residual fuel	26.25	11.33	7.58	3.78
Natural gas	15.40	5.42	2.12	1.40
Others	—	2.07	1.34	0.98

e = Estimate.

Source: Canadian Pulp & Paper Assn.

CANADIAN PAPER INDUSTRY CAPITAL SPENDING ON ENERGY AND POWER PROJECTS, 1983-85*

Region	Expenditures (C$000)	% of total energy/power capital budgets
Maritimes	C$159,260	44%
Quebec	124,881	35
Ontario	51,335	14
Central	6,400	2
West	19,754	5
Total	361,630	100
% of total capital spending, all purposes	11%	

* Includes projects, as announced, for 1986 and beyond.

Source: PULP & PAPER January 1984 Capital Spending Survey.

CHEMICAL USE

Chemicals made up 16.1% of the total cost of materials and supplies for the Canadian pulp and paper industry in 1982, representing a C$785-million expense for the industry, according to Statistics Canada figures. Of that figure, **caustic soda** claimed by far the biggest share, 21.9% in terms of value. This percentage has remained stable in recent years: in 1980 for example, it was 21.7%. Volume estimates for total chemical consumption are less meaningful, but in those terms caustic soda is also most important, representing 843,221 metric tons in 1982. However this volume of caustic soda consumption is an 11% decline from 1980's level of 951,019 metric tons used by the pulp and paper industry. **Sodium chlorate** is used by pulp mills to generate chlorine dioxide, a popular bleaching agent. Consumption of sodium chlorate in terms of volume fell 7% from 1981 to 1982 as a result of weak pulp production, but 1983 demand increased slightly as the industry pulled out of recession.

The price of sodium chlorate was expected to grow 10% in 1984, according to a study by *Pulp & Paper* Consulting Editor Barry Shockett. Projected prices for 1985 indicate a slowdown in the rate of price increase, reflecting both market firming and the considerable discounting that has occurred since 1983. The list prices for sodium chlorate and caustic soda, for example, are expected to increase 5% to 6% in 1985. Hydrogen peroxide prices were expected to rise 12% in 1984, in contrast to 1985 projections calling for an increase of 7%.

Major pulp and paper industry chemicals, with pricing, late 1983 availability and demand forecasts, include the following:

Aluminum sulfate, $131.54 to $139.71/ton, liquid, f.o.b. Valleyfield, Que.; availability: supply/demand in balance. Alum mill usage is projected to increase with an average annual growth rate of 4.5% through 1987. **Caustic soda**, $417/ton, 50% solution, bulk, f.o.b. works, freight equalized; availability: sufficient capacity to meet domestic consumption requirements, expected to increase 5% to 6% in 1984. **Chlorine**, $308.45 to $344.75/ton, bulk, f.o.b. works; availability: excellent. While chlorine usage by pulp mills will decrease over the long run as chlorine dioxide substitution continues, mill demand is expected to grow 2% annually until 1987. **Hydrogen peroxide,** 58.7¢/lb, bulk, 70% solution, f.o.b. Toronto; availability: supply/demand in balance. **Sodium hydrosulfite**, blended, 69.4¢ to 71¢/lb, delivered eastern Canada; nonblended, 61¢ to 68¢/lb; availability: supply/demand in balance. Annual demand growth for next 3 to 4 years should average about 8%. **Kaolin clay**, water-washed No. 1 coating grade: $218 to $255/ton, f.o.b. Georgia; dry-ground, air-floated filler grade: $60/ton; availability: supply/demand in balance. Mill demand is projected to increase 5% to 7% for coating and filler pigments, respectively, through 1987.

Lime, $60/ton, bulk, f.o.b. plant; availability: supply/demand in balance. The percentage of total lime consumption by mills will decline over the long run as oxygen enrichment in the lime kiln gains popularity.

MAJOR CHEMICAL SUPPLIES USED BY CANADIAN PULP & PAPER INDUSTRY, 1977, 1980 AND 1982

(C$000)

Material or chemical	1982	1980	1977
Caustic soda	97,430	161,484	192,667
Liquid chlorine	59,044	89,796	95,590
Sodium chlorate	39,648	74,865	79,590
Saltcake	22,574	24,179	24,583
Starch	17,794	26,496	26,111
Sulfur	16,196	23,611	29,312
Foam & slime killers	13,197	32,355	22,393
Sulfuric acid	11,990	20,034	24,235
Other mat. and chem.	190,043	293,059	290,509
TOTAL	467,916	745,879	784,990

Source: Statistics Canada

However, lime usage should grow 3% to 4%/yr over the next four years. **Saltcake**, $75 to $81/ton, bulk, f.o.b. production point; availability: supply/demand in balance. Over the long run, effluent recycling from chlorine dioxide generators will reduce mill saltcake purchases by 2%/yr. **Sodium chlorate**, $435/ton, bulk, f.o.b. works, freight equalized; availability: supply/demand in balance. Pulp mill chlorate demand is expected to increase 8% per year. **Starch**, native pearl $19.79 to $21.77/100 lb bags, f.o.b. Toronto; availability: supply/demand in balance. Annual growth in mill demand should average 2% to 3% through 1987.

Sulfur, crushed, slate, or molten, $78.72 to $83.64 /metric ton, f.o.b. producing point; availability: supply/demand in balance. Total usage by mills is expected to drop over the long run. **Sulfuric acid**, 66 Baume, $89.63/ton, bulk, f.o.b. producing points, eastern Canada; availability: supply/demand in balance. **Titanium dioxide**, untreated anatase, $80/100 lb, delivered, truckload, bags; availability: supply/demand in balance. The paper industry's demand is projected to increase at an annual average of 8% through 1987.

TRANSPORTATION

The forest products industry is among the Canadian rail industry's most important customers. In 1983, 577,000 cars loaded with forest products represented 18% of Canada's total 3.2 million carloadings (shares in 1980, 1981 and 1982 were 18.5%, 17.4% and 16.6%, respectively). The share of all carloadings represented by pulp and paper products alone in 1983 and 1982 was 5.6%, although this was down from 6% in 1980 and 1981.

Unlike their U.S. counterparts, Canadian mills during the 1970s enjoyed a relatively stable transportation environment due to the near-total deregulation of Canadian transport industries following the National Transportation Act of 1967.

With the passage of the U.S. Staggers Act of 1980, however, that stable environment may undergo radical changes. The U.S. act authorizes secret contracts and rebates, both of which constitute criminal matters under existing Canadian railway legislation.

The Canadian Transport Commission is currently conducting a study into the potential effects of the Staggers Act on the Canadian railway industry, and public hearings began in the fall of 1984. Canadian railways claim that they have lost $100 million in revenue in recent years following implementation of the Staggers Act, but the Ministry of Transportation has no documentation substantiating this allegation.

Rail line/shipper disputes. Another major concern of the industry is its desire to get the National Transportation Act amended to provide more favorable arbitration procedures governing disputes with rail lines.

According to an article in the October 1984 edition of the journal of the International Forest Products Transport Assn., "At the moment, the only recourse shippers have is to undertake an appeal based upon proving that whatever injustice has occurred is contrary to the public interest of Canada. This is a very costly and time-consuming procedure and as such is not an avenue that is available to small or even modest-sized companies. There was a successful appeal brought by 16 western Canadian woodpulp producers. This case started in 1978 and, while successful, it was not until 1982 that appeal procedures had been exhausted."

There are other areas of regulatory concern for the industry. The Ministry of Transportation has continued to tighten up rules for transport of hazardous wastes, including some paper industry supplies. It has issued new legislation: the Transportation of Dangerous Goods Act, whose provisions were coming into force at the end of 1984. Transportation officials do not expect the new regulations to cause major changes for the railways.

Meanwhile, efforts to improve the construction and safety of chemical transport boxcars are well underway. For example, a new 90-ton thermally insulated chlorine car has been designed to prevent explosions during fire. The new insulation, composed of a mixture of glass fiber and ceramic material, is better able to withstand extreme changes in temperature than the presently used cork or polyurethane insulation.

Other rules, many of which have gone into effect over the paper industry's objections, include speed slowdowns in developed areas, installation of special couplers and other modifications. Industry officials fear the end result of those regulations will be added chemical costs for mills.

Cost control all along the line is more important for pulp and paper mills than it was before the escalation of fuel costs in the early 1970s. Finished product transport costs alone can represent 15% of mill costs for woodpulp and twice that for some wood products.

Ocean transport. Much of Canada's pulp and paper output is shipped by water, since a large portion of the industry's production is sold to U.S. or overseas customers. Although most shipments to the U.S. move by rail, eastern Canadian mills have experimented with barge shipments to the U.S. East Coast, and barge transport is used from British Columbia, too.

Because they are so heavily reliant on ocean transport, Canadian mills have sometimes been in the forefront of experimentation on different shipping methods. For example, the October 1984 journal of the IFPTA notes that mills controlled by Canadian Forest Products Ltd. were "among the pioneers in pulp unitization in the mid-1960s." Studies continue into new ways to speed up shipment and cut vessel turnaround time. Canfor, for example, is looking at loading methods such as a conveyor line system from warehouse to shipside at its Port Mellon, B.C., mill.

Although containerization is not currently the predominant shipping method, the IFPTA article foresees some future increase in containerization. But, it notes, "Most carriers who are serving the B.C. pulp and paper trade are replacing vessels with the same types of open-hatch gantry crane vessels that are being used today."

On the government front, one of the biggest concerns of pulp and paper mills in Canada results from discussion about offering federal assistance to creation of a large Canadian-flag merchant marine. Mills are concerned about possible implications for costs of such a fleet, should they be required to ship a certain percentage of their cargo on national-flag vessels, and also worry that such a fleet—if it were developed with defense priorities in mind—would tend to emphasize ro-ro (roll-on/roll-off) vessels rather than the open hatch ships preferred by most mills.

Trucking innovation. In the area of trucking, the major innovation in recent years seems to be the development of trailers capable of handling larger loads. From a standard truckload of 20 tons, developments have carried maximum load up to 45 tons in the case of a "Super B Train" setup that is used to haul sulfuric acid for pulp mills. [The same kind of increases have been seen in the case of rail cars: for example, the October IFPTA journal notes that CP Rail has developed a 66-ft bulkhead flat car for transport of export woodpulp from Weyerhaeuser Canada's Kamloops, B.C., mill, which can haul 91 tons, an increase of a third from earlier limits.]

CARLOADING OF MAJOR CANADIAN RAILROADS, 1978-83

	1983	1982	1981	1980	1979	1978
(000 cars loaded)						
Pulp & paper	180	174	219	227	231	228
Pulpwood	195	180	205	233	233	230
Other forest products	202	160	205	241	262	289
Total forest products	557	514	629	702	726	747
All rail carloadings	3,207	3,096	3,609	3,796	3,889	3,737
(000 metric tons)						
Pulp & paper	10,372	9,728	11,647	11,888	11,917	11,694
Pulpwood	11,102	9,960	11,156	12,563	12,550	12,233
Other forest products	10,021	7,669	9,713	10,935	11,816	12,864
Total forest products	31,495	27,357	32,516	35,386	36,283	36,729
Total traffic loaded	220,163	212,116	253,743	236,164	237,380	218,783

Source: Statistics Canada.

ENVIRONMENTAL SPENDING AND REGULATIONS

Canadian pulp and paper mills planned to spend C$410 million on environmental projects in the mid-1980s, nearly 12% of total announced capital expenditures, according to a January 1984 *Pulp & Paper* survey covering the years 1983-85, including announced projects through 1986.

Of the announced budget, 52.7% was intended to improve water quality, 46% to clean up air emissions and 1.2% to resolve solid waste disposal problems. The regional breakdown for these environmental expenditures is as follows: **water quality:** Maritimes, 5% of nation's expenditures; Quebec, 65%; Ontario, 16%; western provinces, 14%; **air quality:** Maritimes, 10%; Quebec, 65%; Ontario, 7%; West, 18%; **solid waste:** Quebec, 67%; Ontario, 33%.

The differences among provinces partly reflect priorities of the various provincial governments, and partly reflect the priorities and abilities of the paper companies themselves. One industry official said, however, that over the long run the provinces are roughly equal in their insistence on continued environmental improvement.

One difference between Canada and the U.S. is that in Canada the major source of power in regulating the environment is in the province rather than the federal government. Situations vary across Canada because of the differences in provincial guidelines.

The federal government has set down some baseline water regulations but doesn't get involved at all in air pollution control as far as the mills are concerned, according to one mill official. Most of the provinces have an agreement with the federal government whereby the provinces agree to impose equivalent or more stringent regulations than the federal ones. The mills, therefore, deal with the provinces on both water and air.

More specifically, federal air pollution control is mainly directed to a leadership and advisory role in assisting provinces to develop air quality standards that may be enforced under provincial legislation.

Federal water pollution legislation is found in the regulations and guidelines that have been established under the Fisheries Act of 1970. These regulations establish liquid effluent requirements for a number of industries. The act makes it an offense to deposit any "deleterious substance" in water frequented by fish or water flowing into water frequented by fish. Deleterious substance is defined in terms of alteration or degradation of water quality so as to harm fish and impair the use of fish by man.

The federal government also sets standards for biochemical oxygen demand (BOD) and suspended solids in effluent discharged by existing, expanded or altered kraft, sulfite or semichemical pulp mills. Any waste found to be toxic according to a prescribed bio-assay procedure is also regulated.

More specific information on the provincial differences in environmental control procedures can be found in a study entitled,"Environmental Standards: A Comparative Study of Canadian Standards, Standard Setting Processes and Enforcement," which is distributed free by the Environment Council of Alberta.

Canadian governments also impose "guidelines" rather than hard-and-fast regulations on existing facilities in some cases, while applying them as regulations for new construction.

Currently, Canada's federal government is focused largely on the issue of the environmentally secure disposal of solid wastes by its pulp mills. According to one government official, suspended solids in pulp mill effluent are seen as probably the most easily damaging component of the effluent. These solids are particularly damaging to the coastal waters.

The problem is that, once these solids are removed from the effluent, they must be disposed of somehow.

At the moment, Canada's federal government is having a difficult time convincing the industry to burn the solids, so it has embarked on a project that will accomplish essentially the same thing the National Council of the Paper Industry for Air and Stream Improvement did in the United States: assess its industry's methods of disposing of solid wastes. Canada is even using NCASI questionnaires so a comparison can be made between the two surveys. Canadian officials feel this cooperative project is a good approach to solving its environmental problems.

In some ways Canada has chosen to go easy on environmental control strategies which U.S. industry finds costly and time-consuming to execute. Air quality modeling, for example, is not widely favored in Canada, one executive noted, while air quality monitoring requirements vary—in some provinces, ambient air monitoring systems are used to trigger control action, while in other cases emissions monitoring is more important because the provincial government is more interested in "end-of-pipe" or facility-specific emissions.

Canada also saves time and money in the area of water pollution by using toxicity of effluent as a criterion for discharge. The industry doesn't like it, but, faced with the question of whether to spend billions of dollars on analytical research as opposed to simply putting a fish into effluent to see if it dies, the relative expenditure is very much in favor of the toxicity test.

According to one government official, this justifies the higher BOD numbers Canada allows its pulp and paper industry. Canada's federal government allows industry to discharge higher levels of BOD, provided the effluent itself has its more toxic components removed.

Another environmental issue that is beginning to plague Canada is the problem of nonpoint source water pollution from logging operations. This issue is solely the responsibility of the provincial governments, however, because Canada's federal government is not allowed to cross into the area of forest management. Its only focus in terms of this issue is on its responsibility for protecting fish habitat.

This is not to say Canadian mills don't have ongoing disagreements with the government over specific environmental problems and policies. A few examples:

- Abitibi-Price Inc. has been negotiating new control orders with Ontario's provincial government covering Abitibi's five mills there. The orders specify that the mills shall do certain things and meet certain regulations by a specified date. These permits cover both air and water pollution control. Abitibi is also having problems with PCB disposal now that PCB's are illegal.

One Abitibi official said that even though the big conventional pollution problems have basically been solved, the provincial governments continue to tighten regulations.

For example, Quebec's provincial government is becoming more and more concerned with the impact of effluents on drinking water quality. It has set up some fairly stringent guidelines for drinking water quality, and is trying to relate them to effluent discharges from pulp and paper mills. This is creating some concern in the Quebec area of the industry and meetings between the industry and the provinces have been scheduled to address the problem.

- In mid-1983, E.B. Eddy Forest Products Ltd. had a series of accidental spills in which 30,000 gallons of detergent were released into Ontario's Spanish River, along with other wastewater—increasing biochemical oxygen demand in the waterway and killing much of the river's fish population.

According to the company, the spills resulted from an inaccurate reading taken from a holding tank, although the company later refused to comment, on the advice of its attorneys.

The company may have to pay up to C$400,000 in provincial fines despite its offer to restock the Spanish

CANADIAN PAPER INDUSTRY SPENDING FOR 1984-86* POLLUTION ABATEMENT EQUIPMENT, BY REGION

(C$000)

Region	Water	Air	Solid waste/ unspecified	Total
Maritimes	$17,725	$16,725	—	$34,450
Quebec	72,110	96,300	2,725	171,135
Ontario	4,050	1,250	2,400	7,700
Central	—	135	—	135
West	38,525	18,055	1,605	58,185
Total	132,410	132,465	6,730	271,690
% of total pollution control capital spending	48.7%	48.8%	2.5%	100%

* Includes projects, as announced, for 1987 and beyond period.

Source: PULP & PAPER January 1985 Capital Spending Survey

River with fish.

The incident occurred just as Eddy was beginning the final stages of installing $50 million in air and water pollution control equipment as part of a $230-million mill modernization.

- In mid-1983, rules to implement the Transportation of Dangerous Goods Act led off the regulatory agenda of the Canadian Environment Ministry. The act contains a series of tight new labeling and packaging rules for hazardous materials shipments—and includes the owner (such as the paper mill) as well as the transporter (railroad or truck line) in potential liability in the event of a spill. With many chemicals—including such hazardous materials as molten sulfur—being purchased on an f.o.b. point-of-origin basis, mills have a choice between buying c.i.f. if they can and paying steeper insurance rates.

With pulp and paper mill byproducts such as tall oil also classified under the act as hazardous substances, mills themselves face additional hazardous waste spill liability worries.

- Perkins Paper Ltd. recently unveiled a $2.1 million treatment system in operation at its tissue mill in Quebec. The system reduces the mill's suspended-particle effluent from the 15 tons of three years ago to 0.5 tpd, and reduces BOD levels from six tpd to 0.8 tpd.
- Quebec's pulp and paper industry, with the help of a federal-provincial modernization program, has made great headway over the past four years in solving its pollution problems, according to environment minister Adrien Ouellette. The goal is to modernize mills so that papermaking production levels increase.

In addition, both the federal and Quebec governments have spent more than $550 million over that period of time to reduce pulp and paper industry pollution. As a result, suspended-particle pollution has been cut by 50% at all 58 pulp and/or paper mills in Quebec, and BOD levels have been cut by 34% to 920 tpd from 1,400 tpd in 1980.

- The provincial government of British Columbia has given Macmillan Bloedel Ltd. a five-year deferment on two of its mills' plans for meeting environmental regulations within the province.

The deferment was issued after company officials explained to the government that, due to economic hardships caused by the financially depressed pulp and paper industry in British Columbia, a lot of what the company had planned to do in the past two years and the next three years regarding environmental cleanup had essentially been deferred already.

The two mills to which the five-year deferment applies are Macmillan Bloedel's Powell River bleached kraft pulp mill on Vancouver Island and its newsprint mill at Port Alberni, both in B.C.

Macmillan Bloedel's biggest environmental concerns, according to one company official, have largely to do with air pollution control. Of the environmental expenditures ahead for the company, nearly three-fourths will be spent on air pollution control, and the remaining amount on water pollution control.

This could change, however, due to an unknown amount that may have to be spent on hazardous waste disposal. Canada does not have the accepted hazardous waste disposal facilities which the U.S. has in its waste disposal sites.

Currently, these wastes are being disposed of within Canada's pulp and paper mills by the use of processing equipment which neutralizes acids and bases.

In addition, the mills use power boilers to incinerate other materials such as oily wastes and lumber shavings treated with pentachlorophenol. The question is, will this be acceptable in the long term?

One mill official says it is industry's general feeling that the government or a contractor should provide for a hazardous waste facility. At this time there is none, so the regulations which are drawn up by the government have not been heavily enforced.

Such reports could be repeated about mills all over Canada. One mill official said the big problem behind all of these incidents is that the provinces are becoming more concerned with the means of regulation than they are with the end results of the regulation. As the discharges are reduced to virtually insignificant levels, the requirements for monitoring those discharges become more and more stringent—which seems a little backward as far as he is concerned.

Still, the similarity of long-term goals of U.S. and Canadian regulators may be seen by the fact that the percentage of total capital expenditures going to environmental programs in Canada, at 12%, is actually higher than the 10% planned by U.S. firms.

PAPER GRADES

Five major groupings make up the paper segment of the pulp, paper and paperboard industry: (1) newsprint, (2) printing papers, (3) fine or writing papers, (4) packaging and converting papers, and (5) tissue papers.

That rough breakdown arranges paper grades according to their overall end-use, but it accepts the industry convention which separates newsprint, the crudest and least expensive publication paper, from the rest of the printing paper sector. This convention has some reason behind it: newsprint mills produce a simpler product than other printing paper mills, with fewer value-added systems such as coaters or supercalenders.

But while that breakdown will serve for a general discussion of papermaking and paper markets, a more detailed look requires that a distinction be made among papers according to how they are made and the specific end-use for which they are intended. It is important to take any classification, of course, with a grain of salt. For example, it is not always easy to separate paper and

PRINTING/WRITING PAPER SHIPMENTS, 1981-83

(000 short tons)

Grade	1981e	1982e	1983*
Uncoated free-sheet total	7,870	7,907	8,767
Offset	1,990	1,981	2,110
Copy/duplicating (BMDX)	1,911	1,949	2,220
Forms bond	1,569	1,569	1,700
Envelope	854	863	920
Tablet	322	325	400
Text & cover	239	230	240
Other	985	990	1,175
Total coated paper	4,947	5,015	5,696
Coated one-side	430*	395*	405*
Coated two-sides Nos. 1-4	1,990	1,930	2,325
Coated two-sides No. 5.	2,517	2,655	2,965
Operating rates			
Uncoated free-sheet	90%*	88%	94%
Coated groundwood	91*	84	95
Coated free-sheet	94*	94	95

e = Estimate.
* PULP & PAPER WEEK estimates.

Source: American Paper Institute, Champion International Corp.

U.S. SHIPMENTS OF PAPER GRADES, 1979-83

(000 short tons)

	1983	1982	1981	1980[1]	1979[1]
TOTAL, ALL GRADES	32,205	30,151	29,816	30,164	29,580
PRINTING, WRITING AND RELATED PAPERS	22,662	20,986	20,791	20,362	19,271
Newsprint	5,266	5,063	5,253	4,660	3,778
Groundwood paper, uncoated	1,604	1,499	1,428	1,538	1,800
Publication and printing	1,383	1,299	(D)	—	—
Supercalendered	394	248	(D)	156	161
Other	989	1,046	1,073	1,138	1,420
Other converting & misc.	(D)	(D)	200	243	
Body stock for coating	(D)	(D)	(D)		220
Coated printing and converting paper	5,852	5,224	4,775	4,751	4,580
Coated groundwood (more than 10% groundwood)	3,526	3,115	2,646	—	—
Coated one side	(D)	(D)	77	123	118
Coated two sides	(D)	(D)	2,568	2,572	2,307
Coated free-sheet (not more than 10% groundwood)	2,326	2,109	2,129	—	—
Coated one side	472	450	455	356	364
Coated two sides	1,853	1,659	1,674	1,700	
Prime coated body stock for further coating	(S)	(S)	(S)		1,791
Uncoated free-sheet (not over 10% groundwood)	8,572	7,890	7,965	8,008	7,655
Writing (chemical woodpulp)	4,837	4,451	4,485	4,066	3,815
Bond and writing, including protective check	2,142	1,946	1,813	1,616	1,447
Forms bond in rolls	1,663	1,535	1,555	1,327	1,330
Ledger	62	60	99	107	117
Mimeograph (all woodpulp furnishes)	84	80	102	98	88
Gelatin and spirit process duplicating	191	164	178	301	234
Papeterie and wedding	47	49	61	48	62
Body stock for communication, copying papers	203	174	238	356	307
Other technical and reproduction papers	123	115	141	122	126
Tablet	274	269	221	—	—
Other, incl. onion skin, manifold, opaque circular	49	59	77	—	—
Publication and printing	2,193	2,064	2,206	2,127	2,048
Plain (MF, EF, antique, bulking, supercalendered)	265	217	342	(D)	(D)
Offset	1,448	1,393	1,443	1,930	1,837
Other publication and printing free-sheet	480	454	421	(D)	(D)
Cover and text papers	372	353	272	263	280
Other converting, misc. free-sheet	1,170	1,022	1,002	620	659
Envelope (white woven)	627	575	547	272	205
Kraft envelope, bleached and brown	350	304	295	—	—
Body stock for coating (off-machine coating)	(D)	(D)	88	—	—
All other converting and misc. free-sheet	(D)	(D)	72	—	—
Bleached bristols, excl. cotton fiber index and bogus	928	879	904	941	957
Tabulating card stock	107	123	153	202	217
Tag and file folder	364	316	311	285	310
Tag	215	191	176	196	199
Folder	149	125	135	89	112
Other uncoated bristols, incl. index, printing postcard	240	234	209	222	188
Coated bristols	217	205	231	232	242
Cotton fiber writing paper and thin paper	440	430	466	464	502
Writing, cotton fiber, including cotton fiber index	160	134	113	131	130
Bond and writing	131	116	90	93	91
Other	29	17	23	7	7
Thin paper	280	297	353	333	371
Carbonizing free from groundwood pulp	(D)	(D)	(D)	196	238
Other	(D)	(D)	(D)	137[2]	134[2]

U.S. PRODUCTION OF PAPER GRADES, cont.	1983	1982	1981	1980[1]	1979[1]
PACKAGING AND INDUSTRIAL CONVERTING PAPER	5,097	4,873	4,994	5,327	5,708
Unbleached packaging, industrial converting	3,391	3,308	3,586	3,718	3,911
Wrapping	90	85	103	137	187
Shipping sack	727	787	967	1,062	1,110
Bag and sack other than shipping sack	1,860	4,154	2,012	2,101	2,115
Specialty packaging (92 lb and under)	326	251	165	2,074[3]	2,085[3]
Other converting, including creping (92 lb and under)	388	331	340	419[4]	499[4]
Packaging, industrial converting, except unbleached kraft	902	828	923	1,145	1,266
Wrapping (MG and MF butchers, misc. wrapping)	65	67	80	103	119
Shipping sack, including comb. kraft and rope	119	105	118	92	102
Unbl and bl sulfite, semibl and bl kraft, & mixtures	95	(D)	84	(D)	(D)
Other shipping sack paper	24	(D)	34	(D)	(D)
Other bag and sack	168	143	176	229	250
Unbl and bl sulfite, semibl and bl kraft; grocers, sack	121	105	124	155	170
Other bag & sack paper	46	38	51	73	80
Other converting (19 lb & over)	209	183	163	251	287
Waxing stock (18 lb & up)	157	136	120	98	113
Other, such as asphalting and creping stock	53	47	42	52	59
Specialty packaging	132	124	209	269	273
Glassine, greaseproof, and vegetable parchment	209	206	177	202	234
Special industrial paper	804	737	485	464	531
TISSUE	4,446	4,291	4,031	4,474	4,601
Sanitary paper	4,337	4,185	3,917	4,298	4,403
Toilet tissue	1,742	1,679	1,533	1,706	1,772
Single-ply	941	962	944	939	978
Multi-ply	802	717	588	766	794
Facial tissue, other than toweling, napkin, and toilet	292	277	298	370	376
Napkin	594	532	474	532	533
Single-ply	467	407	341	409	404
Multi-ply	127	125	133	123	129
Toweling, excluding wiper stock	1,449	1,433	1,253	1,439	1,482
Sanitary napkin stock wadding	99	113	116	103	98
Wiper stock, regular, facial, and wadding type	60	56	129	74	63
Other sanitary stock	99	94	114	74	78
Tissue paper, excluding sanitary and thin	110	106	114	176	198
Wrapping tissue	(D)	(D)	(D)	72	63
Waxing tissue stock	(D)	(D)	(D)	24	31
Creped wadding for interior packaging	(D)	(D)	(D)	25	41
Other tissue paper, excluding sanitary and thin	20	21	25	18	21

(D) Data withheld to avoid disclosing figures for individual companies.

(S) Suppressed because the data did not meet publication standards of the Bureau of the Census.

[1] Reported as production by Bureau of the Census prior to 1981.

[2] Cigaret, condenser, other.

[3] Grocery bag and sack paper.

[4] Other unbleached kraft bag paper.

Source: Bureau of the Census.

U.S. PRODUCTION AND CAPACITY FOR PAPER GRADES

(000 short tons)

	Production[1]		Capacity[2]		
	Tonnage	% change	Tonnage	% change	Utilization rate (%)
1985	—	—	37,297	1.2	—
1984e	34,844	5.7	36,851	3.3	94.6
1983	32,976	8.4	35,675	2.8	92.4
1982	30,422	−2.0	34,696	2.9	87.7
1981	31,030	2.5	33,706	3.2	92.1
1980	30,281	0.9	32,659	4.7	92.7
1979	30,012	5.3	31,179	2.4	96.3
1978	28,506	1.4	30,460	2.1	93.6
1977	28,096	5.5	29,831	2.1	94.1
1976	26,612	14.1	29,210	0.9	91.1
1975	23,306	−12.6	28,922	1.3	80.5
1974	26,674	0.7	28,532	3.2	93.4
1973	26,483	4.1	27,621	1.7	95.3
1972	25,435	6.8	27,156	3.3	93.6
1971	23,811	0.7	26,270	1.7	90.6
1970	23,625	0.1	25,806	2.1	91.5
1969	23,596	—	25,257	—	93.4
Average 1974-84		2.7%		2.6%	

1. Bureau of the Census data. Includes newsprint, printing/writing, packaging & industrial papers and tissue.
2. American Paper Institute.

e = PULP & PAPER estimate.

CANADIAN PRODUCTION AND CAPACITY FOR PAPER GRADES

(000 short tons)

	Production[1]		Capacity[1]	
	Tonnage	% change	Tonnage	% change
1985	—	—	14,547	1.9
1984e	13,318	6.2	14,270	0.9
1983	12,536	6.5	14,149	1.9
1982	11,772	−6.9	14,012	3.8
1981	12,640	3.6	13,502	4.0
1980	12,200	−0.5	12,975	0.9
1979	12,259	0.9	12,855	2.0
1978	12,148	9.0	12,603	0.9
1977	11,146	3.6	12,493	0.8
1976	10,757	17.1	12,396	1.0
1975	9,186	−22.0	12,275	0.9
1974	11,782	6.0	12,168	−1.0
1973	11,120	3.9	12,292	1.4
1972	10,700	4.7	12,121	—
1971	10,215	−1.4	—	—
1970	10,357	−0.1%	—	—
1969	10,372	—	—	—

1. Excludes building papers.

e = Estimate.

Source: Canadian Pulp & Paper Assn.

paperboard grades into their respective groups. For instance, some paper grades, such as bristols, have basis weights similar to paperboard grades.

This report relies on classifications established by the U.S. Bureau of the Census and those used by American Paper Institute (API) and Canadian Pulp & Paper Assn. (CPPA). These classifications distinguish, for example, uncoated free sheet—source of most fine papers but also of a large volume of printing papers for certain uses—from coated paper, used almost exclusively for publishing and commercial printing. They also draw a line between coated publication papers and uncoated groundwood paper—both used widely for magazines, catalogs, newspaper inserts and the like, but representing opposite ends of the publication-paper price spectrum, and thus intended for completely different types of publications.

It is also important from the papermaker's point of view to distinguish, for example, between free-sheet papers—made with little or no mechanical pulp—and groundwood papers, commonly made with stone groundwood or thermomechanical (TMP) pulp, or between the wood-fiber papers that make up better than 95% of all paper and the cotton-fiber papers that make up a small but stable sector of the fine paper group.

Therefore this report will approach the paper side of the industry by looking at eight major subgroupings which are commonly understood and accepted in the paper industry:

- Newsprint
- Uncoated groundwood papers
- Coated papers
- Uncoated free-sheet papers
- Cotton-fiber papers
- Bristols
- Packaging and industrial converting papers
- Tissue

Each chapter will examine detailed production and market distinctions within these categories, and will examine any important trends in production technique or end-use.

Some generalizations apply to the entire paper sector. Paper grades are generally produced on fourdrinier paper machines or twin-wire formers, but in a few cases cylinder board machines or multi-ply formers are used instead. Paper machines exist in all sizes and configurations according to the single grade of paper to be produced or even to a papermaker's particular requirements for his own product.

The process seems very simple: a slurry of fibers and water is drained (dewatered) on a wire, after which further excess water is removed by pressing and drying. The dried sheet is then wound on a reel from which rolls or sheets of paper are produced.

But in reality, papermaking is a complex process, combining sophisticated and evolving technology and decades of experience.

The intent of this report is not to discuss papermaking in detail; numerous technical reference books exist for this purpose. The main purpose of this work is to

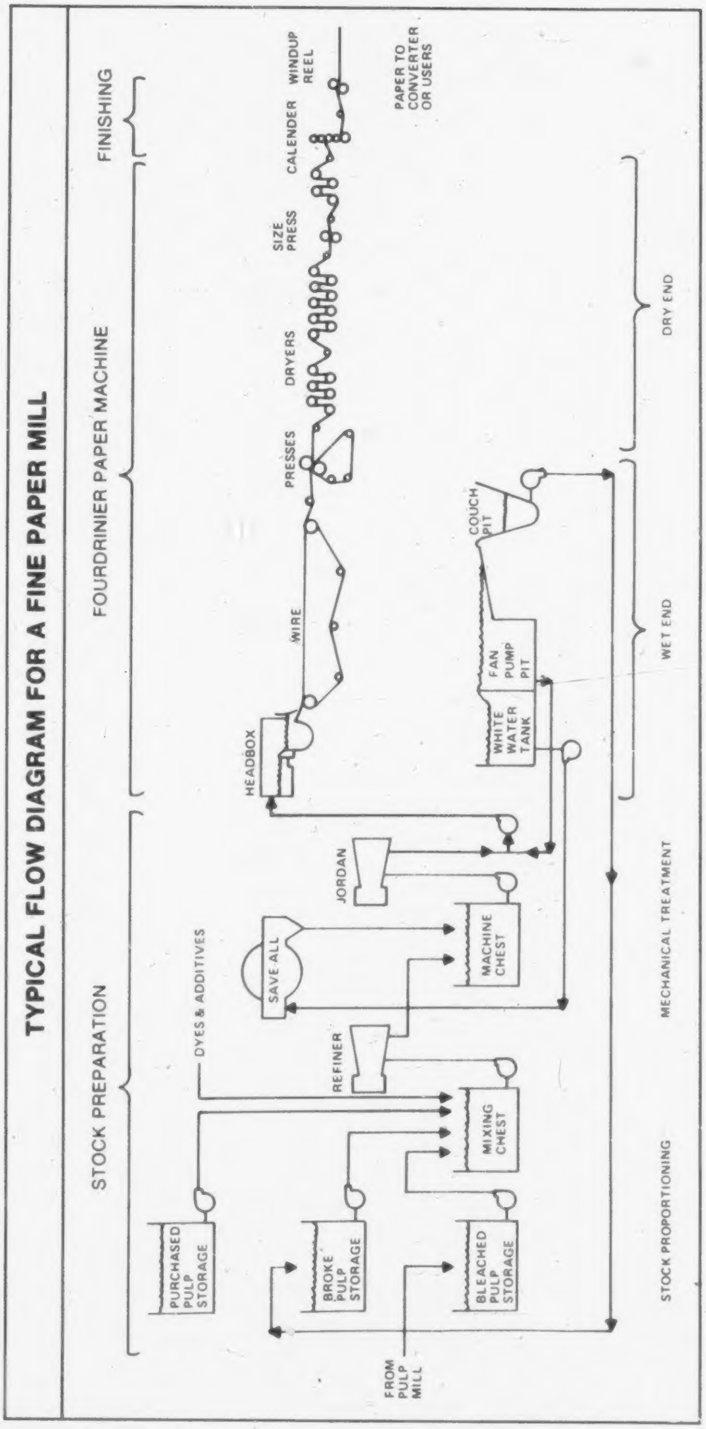
CANADIAN PAPER PRODUCTION

(000 short tons)

	Newsprint	Groundwood printing/ specialty	Other book & writing	Wrap-ping papers	Tissue/ sanitary	Building papers	Total
1984e	9,835	1,270	1,275	497	441	150	13,468
1983	9,354	1,046	1,168	535	433	155	12,691
1982	8,939	887	1,010	514	442	137	11,909
1981	9,866	883	880	577	434	130	12,770
1980	9,507	677	987	613	416	140	12,340
1979	9,551	624	1,008	668	408	138	12,397
1978	9,670	580	871	637	390	142	12,290
1977	8,988	463	759	571	365	155	11,301
1976	8,915	384	544	580	335	165	10,923
1975	7,679	311	437	475	283	161	9,346
1974	9,548	416	748	709	361	158	11,940
1973	9,140	222	762	671	324	163	11,282
1972	8,820	296	675	597	312	172	10,872
1971	8,455	299	631	540	289	147	10,361
1970	8,719	289	616	493	240	101	10,458
1969	8.818	214	544	514	281	116	10,487

e = Estimate.

Source: Canadian Pulp & Paper Assn.



TYPICAL FLOW DIAGRAM FOR A FINE PAPER MILL

STOCK PREPARATION
FOURDRINIER PAPER MACHINE
FINISHING
PURCHASED PULP STORAGE
BROKE PULP STORAGE
BLEACHED PULP STORAGE
FROM PULP MILL
DYES & ADDITIVES
MIXING CHEST
REFINER
SAVE ALL
MACHINE CHEST
JORDAN
HEADBOX
WIRE
PRESSES
DRYERS
SIZE PRESS
CALENDER
WINDUP REEL
PAPER TO CONVERTER OR USERS
WHITE WATER TANK
FAN PUMP PIT
COUCH PIT
STOCK PROPORTIONING
MECHANICAL TREATMENT
WET END
DRY END

provide the reader with an overall introduction to the most important sectors of the paper industry, with discussions elsewhere in the book of important themes for the entire pulp, paper, and paperboard industry.

While reading chapters on particular grades of paper, however, the reader should keep in mind that no two mills make the same grade of paper by exactly the same method or with the same equipment.

One mill may make newsprint on a twin-wire former using 100% wastepaper, while other mills may produce a similar quality of newsprint with a fourdrinier machine and groundwood pulp. Some paper mills are modern, using the most up-to-date, large-scale equipment available, whereas other paper mills make similar grades on small equipment at 100-year-old sites—mills still in operation because they serve a particular market need, and because using entirely paid-for equipment permits them to do so economically.

VALUE OF SHIPMENTS OF PRIMARY PAPER PRODUCTS

($ million)

	1982	1981	1979	1977	1975
TOTALS[1]	19,417	19,607	15,784	12,438	9,370
Newsprint	2,138	2,187	1,226	989	828
Uncoated groundwood	733	765	723	539	403
Publication/printing	—	—	—	—	—
Others	—	—	—	—	—
Coated printing & converting	3,596	3,446	2,825	2,261	1,473
Coated one side	—	462	—	—	—
Coated two sides	—	2,984	—	—	—
Uncoated printing/writing[2]	5,463	5,660	4,666	3,353	2,845
Writing, chemical pulp	3,107	3,221	—	—	—
Publication/printing	1,414	1,521	—	—	—
Cover/text	320	277	—	—	—
Other	621	641	—	—	—
Book paper	—	—	—	—	1,073
Cotton fiber and thin	666	696	645	496	—
Bleached bristols	563	585	502	474	355
Unbleached kraft packaging[3]	1,151	1,343	1,244	1,099	873
Packaging and converting[4]	797	758	760	561	439
Special industrial	631	617	575	551	389
Tissue	3,679	3,550	2,618	2,116	1,765

1 Totals are higher than individual values due to inclusion of nonclassified grades.
2 Uncoated-free sheets.
3 Plus industrial converting papers.
4 Except unbleached kraft.

MARKET INDICATORS FOR PAPER GRADES: ADVERTISING INDEXES

(1967 = 100)

	General index	Television	Spot TV	Magazines	Newspapers
1984	516	639	551	390	483
1983	450	555	485	340	419
1982	395	493	441	298	360
1981	344	383	379	284	323
1980	307	353	331	253	278
1979	274	312	293	235	246
1978	241	269	263	209	214
1977	210	238	223	174	198
1976	183	196	218	144	178
1975	146	158	164	118	144
1974	140	147	151	121	141
1973	130	135	139	116	131
1972	125	124	133	116	130
1971	112	109	116	110	117
1970	112	114	125	104	105
1965	90	85	90	93	93
1960	67	56	53	73	92

Source: Based on average monthly expenditures for those media giving national coverage. McCann-Erickson advertising index via Survey of Current Business, Bureau of Economic Analysis, Census.

MARKET INDICATORS, PRINTING & PUBLISHING PAPERS: VALUE OF SHIPMENTS

($ million current)[1,2]

SIC code:	Newspapers 2711	Periodicals 2721	Book publishing 2731	Book printing 2732	Commercial printing 2751,2,4,	Manifold business forms 2761
Year						
1984e	26,695	14,664	9,365	2,845	31,805	5,946
1983e	24,050	12,943	8,475	2,600	28,785	5,195
1982	21,286	11,525	7,723	2,392	27,091	5,034
1981	20,050	9,843	6,760	2,556	23,149	4,735
1980	17,750	9,229	6,675	2,325	19,700	4,308
1979	16,125	8,240	6,040	2,100	18,200	3,846
1978	14,500	7,292	5,495	1,920	16,500	3,259
1977	12,966	6,077	4,882	1,696	14,800	2,884
1976	11,659	5,044	3,968	1,328	13,355	2,328
1975	10,433	4,380	3,537	1,241	11,691	2,185
1974	9,568	4,059	3,349	1,127	10,864	2,305
1973	8,868	3,856	3,143	1,064	9,961	1,708
1972	8,270	3,521	2,857	938	9,111	1,430
1971	7,355	3,239	2,739	891	8,133	1,278
1970	6,967	3,096	2,434	800e	7,865	1,233

1. Value for industry, including service.

2. Other printing categories, such as engraving and plate printing, greeting card publishing, blankbooks and looseleaf binders, bookbinding work, typesetting, photoengraving, electrotyping and platemaking services are not included but amounted to $7.2 billion in 1984.

e = Estimate.

ESTIMATED NUMBER OF U.S. MACHINES PRODUCING PAPER GRADES[1]

	Machines in 1982		Machines in 1975	
	Number	Average tpd per machine	Number	Average tpd per machine
Total paper	910	108	981	84
Newsprint	44	359	38	288
Uncoated groundwood	34	136	38	100
Coated papers	84	185	81	143
Uncoated free-sheet*	264	97	278	74
Thin papers	44	25	62	17
Solid bleached bristols	15	200	16	213
Packaging & ind. converting	194	90	228	80
Tissue	231	63	240	53

[1] Because some machines can produce more than one grade, classifications are considered estimates.
* Includes cotton fiber.

Source: American Paper Institute capacity surveys.

PUBLICATION PAPER SHIPMENTS ACCORDING TO PRINTING TECHNOLOGY, 1980

(% of total for each grade)

Grade	Offset	Letterpress	Rotogravure
Coated two-sides Nos. 1-4	96	1	3%
Coated two-sides No. 5	55	24	21
Uncoated free sheet	96	4	—
Uncoated groundwood	44	35	21
Newsprint*	25	57	n.a.

* American Newspaper Publishers Assn. estimate for percentage of total U.S. newsprint consumption used by U.S. daily newspapers for each method of print in 1979, latest available year. Does not include consumption by government, or preprinted inserts or other consumers.
n.a. = Not available.

Source: PULP & PAPER estimate.

NEWSPRINT

GRADE STRUCTURE

Newsprint is manufactured primarily for regularly appearing sections of daily and weekly newspapers and for commercial printing end uses such as preprinted newspaper inserts and government printing jobs, which consume almost 3 million short tpy of newsprint in the U.S. Most of the furnish for newsprint manufacture is mechanical pulp, with chemical pulp being added to improve runability on the paper machine and printing press.

The standard basis weight for newsprint in the U.S. is 30 lb/3,000 ft^2 or 48.8 g/m^2, but St. Regis Corp.'s Southland Div. makes newsprint at 28.5 lb (46.4 g/m^2), and Great Northern Nekoosa Corp.'s standard is 28 lb. Some mills make paper up to 35-lb basis weight (56.9 g/m^2). Standard basis weight before 1974 was 32 lb (52.1 g/m^2), but this was reduced to 30 lb as a cost- and fiber-saving device. Reductions to an average of about 28.5 lb or less are possible, but significant reductions are not likely because of anticipated consumer resistance.

Slight variations in surface qualities of the sheet are introduced to conform to needs of the three major printing methods used by the newspaper industry. Letterpress printing is the favored method in the U.S., but offset printing gained popularity in the 1970s before leveling off at about 25%. Many publishers installed offset presses in the 1970s, and consumption of paper for offset printing jumped 39% in 1979 from 1978, hitting 2.825 million short tons. After 1979, however, the American Newspaper Publishers Assn. stopped tracking the trend in offset printing because installation of offset presses slowed down to match overall newsprint demand growth, keeping offset's share of the market largely unchanged.

Rotogravure is still preferred for longer runs (for example, over 1 million copies). Rotogravure newsprint is priced about 10% higher than the other two grades of newsprint, and within each grade there are variations in basis weight, opacity and brightness.

Most newsprint is made on fourdrinier paper machines, although an increasing number of mills are switching to twin-wire units when they add new machines. Mills with existing fourdriniers in Canada and elsewhere have retrofitted those units with twin-wire formers (such as the Bel Baie former, Dynaformer, Papriformer or Verti-Forma), to improve sheet characteristics and add marginally to machine speed on fourdriniers that are drainage-limited. Speedup results because of faster drainage, and a twin wire also produces paper with less two sidedness, which is particularly attractive with offset grades. The changeover is relatively inexpensive, and at least one

STATISTICS FOR NEWSPRINT

	1982	1983	1984e
UNITED STATES			
Production, 000 short tons*	5,041	5,168	5,425
Capacity, 000 tons	5,564	5,747	5,771
Utilization rate, %	89.2	89.9	94.0
Apparent U.S. consumption			
000 tons	11,150	11,677	12,380
lb/capita	96.5	100.1	105.1
000 tons/$ billion real GNP	7.51	7.60	7.75
CANADA			
Production, 000 short tons	8,947	9,354	9,835
Capacity, 000 tons	10,951	10,990	10,951
Utilization rate, %	81.7	85.1	89.8

e = Estimate.
* All tons are short tons.

Source: PULP & PAPER

equipment manufacturer claims it can be accomplished in as little as two days.

Most newsprint is not sized other than having alum added at the grinders to prevent resin buildup. Because of the high opacity of groundwood pulp, fillers are generally not needed. Bleaching is done with peroxides or hydrosulfites, giving a final brightness of about 55 or 60 in contrast with the 60 to 65 brightness range preferred for higher grades of uncoated groundwood paper, such as directory.

Groundwood pulp makes up the bulk of furnish in most newsprint mills, while thermomechanical pulp has come into increasing usage—and in a few cases, such as F.F. Soucy Inc.'s Rivière-du-Loup, Que., facility, TMP is used exclusively. In many mills TMP has been employed to replace some chemical pulp. Chemical pulp, with its longer fibers, typically makes up 10% to 15% of newsprint furnish in order to improve sheet strength, with unbleached softwood sulfite pulps widely used in Canada and semibleached sulfate softwood pulp preferred in the U.S. But TMP has greater strength than groundwood pulp—although it still is weaker than chemical pulp—while costing less than chemical pulp and thus represents an economical partial replacement for sulfate or sulfite pulps.

Some mills also manufacture newsprint from deinked

ESTIMATED ANNUAL NEWSPRINT CAPACITY OF MAJOR COMPANIES

(000 short tons)

	Canada	U.S.	Total	Capacity share (%)
1. Abitibi-Price	1,796	463[1]	2,259	13.6%
2. Bowater	464[2]	975[3]	1,439	8.7
3. CIP	1,265[4]	—	1,265	7.6
4. Consolidated-Bathurst	1,070	—	1,070	6.4
5. MacMillan Bloedel	909	—	909	5.5
6. St. Regis	—	811	811	4.9
7. Boise Cascade	285	510[5]	795	4.8
8. Kimberly-Clark	361[6]	393	754	4.5
9. Ontario Paper	710	—	710	4.3
10. Publishers Paper	—	568	568	3.4
11. Kruger	526	—	526	3.2
12. North Pacific[7]	—	440	440	2.6
13. B.C. Forest Products	436	—	436	2.6
14. Donohue	399[8]	—	399	2.4
15. Reed Paper	390	—	390	2.3
16. Crown Forest	381	—	381	2.3
17. Great Lakes For. Prod.	381	—	381	2.3
18. Garden State Paper	—	340	340	2.0
19. Domtar	293	—	293	1.8
20. Great Northern	—	285	285	1.7
21. Southwest Forest	—	275	275	1.7
22. Crown Zellerbach	—	200	200	1.2
23. Bear Island	—	185	185	1.1
24. F.F. Soucy	184	—	184	1.1
25. James Maclaren	176	—	176	1.1

Total North American capacity (1984): 16.605 million tons
Capacity share of top five companies: 41.8%
Capacity share of top ten companies: 63.7% (unchanged)

[1] Includes 77,000 tpy from Boise Southern, DeRidder, La.; balance assigned to Boise Cascade.

[2] Includes Corner Brook, Nfld., mill, 300,000 tpy, which is being sold.

[3] Includes 230,000 tons from Catawba Newsprint (51% owned); also 727,000 tons from Calhoun, Tenn.

[4] Subsidiary of Canadian Pacific Enterprises Ltd.

[5] Includes 326,000 tons at Boise Southern Co.

[6] Includes production at Spruce Falls Power & Paper Co. (50.5% owned).

[7] Subsidiary of Weyerhaeuser Co. and Jujo Paper Co. Ltd.

[8] Includes tonnage at Donohue Inc., 40,000 tons; Donohue Charlevoix, 118,000; Donohue Malbaie, 81,000; and 160,000 tons at Donohue Normick, Amos, Que.

waste newspapers. Garden State Paper Co. operates two mills making newsprint entirely from deinked old newspapers. Both mills are located in urban areas where plentiful supplies of wastepaper exist.

Other mills use deinked newsprint and mechanical pulp or TMP, while still others (such as F.F. Soucy) use TMP by itself. The mix of wastepaper and mechanical pulp varies widely from mill to mill according to fiber availability and the specific cost structure of the mill. Bear Island Paper Co.'s Doswell, Va., mill is using 95% TMP with 5% chemical pulp. Southeast Paper Manufacturing Co. in Dublin, Ga., uses 90% or more waste news in its furnish, with the balance thermomechanical pulp. Consolidated-Bathurst Inc.'s new Bridgewater mill in the U.K. is designed to consume 30% deinked news, 5% bleached softwood kraft pulp and 65% TMP.

INDUSTRY STRUCTURE

Canada is the home of the bulk of North American newsprint capacity, producing about 64% of the 14.5 million short tons of newsprint manufactured in North America in 1983. Approximately 71% of its output was shipped to the U.S., representing about 57% of U.S. consumption for 1983.

In the last decade, however, the most rapid capacity expansion has occurred in the U.S. industry rather than in the Canadian industry. Between 1979 and 1984, U.S. capacity went up by 41.2%, while Canadian capacity rose by only 12.7%. Between 1974 and 1984, U.S. capacity rose by 2.2 million short tons compared with a Canadian capacity increase during that period of only 1.2 million short tons.

North American capacity growth slowed down considerably in the last year or two with producers caught in a squeeze between stagnant prices, high capital costs, slow domestic demand growth and declining demand in some overseas markets. More and more old Canadian machines are likely to be converted to produce uncoated groundwood papers under competitive pressure from increasingly more profitable U.S. mills, further retarding capacity growth.

Due to the high capital cost of new mills, along with dwindling reserves of untapped forest land, Canadian capacity expansion in the future is likely to be concentrated in incremental expansions and additional machines at existing mills. Indeed, the only new

NET NORTH AMERICAN NEWSPRINT CAPACITY CHANGES

(through 1985)

Announced projects	**Location**	**Net change** (000 short ton)	**Startup**
Publishers Paper	Oregon City, Ore.	−25	1984
Reed Paper	Quebec City, Que.	30	1982-5
Great Northern	East Millinocket, Maine	34	1984
Maclaren[1]	Masson, Que.	10	1985
Ontario/Q.N.S.	Baie Comeau, Que.	5	1985-6
Boise Canada	Kenora, Ont.	30	1986
Con-Bath/Pt. Alfred	Ville de la Baie, Que.	72	1987
Under study			
Abitibi-Price[1]	Grand Falls, Nfld.	—	n.a.
Abitibi-Price[1]	Iroquois Falls, Que.	—	n.a.
Abitibi-Price[1]	Alma, Que.	—	n.a.
Boise Cascade*	South Carolina	n.a.	n.a.
Carolina Forest Products* (Stora Kopparberg)	Bennetsville, S.C.	530	n.a.
Great Lakes*	Dryden, Ont.	175	n.a.
Grenada Paper Co.*	Grenada, Miss.	215	n.a.
Kruger*	Trois Rivieres, Que.	172	n.a.
Prince Albert Pulp*	Prince Albert, Sask.	n.a.	n.a.

n.a. = Not available

*New machine.

1. New machine(s) replacing existing unit(s).

2. Decision made in February 1984 to permanently idle unit that had been down since April 1982.

Note: All other changes listed involve rebuilds, speedups, etc.

Source: PULP & PAPER PROJECT REPORT.

machines currently being considered for North America, other than those contemplated to replace existing equipment, are a U.S. machine (Southeast Paper), a politically motivated mill on the Matane Peninsula of Quebec, and a series of long-shot possibilities or long-term future prospects in the U.S.

Many Canadian newsprint machines date back to the 1920s and 1930s, and most are two to three decades old. Despite rebuilds and speedups, these relatively inefficient machines in some cases cannot compete with modern fourdrinier and twin-wire paper machines. U.S. mills also have a fiber cost advantage with U.S. southern mills enjoying wood costs that are more than a third lower than those of eastern Canada. And, being located closer to those markets, U.S. mills benefit from a transportation cost advantage, although that advantage is partially offset by higher financing costs in the relatively newer U.S. mills.

Netted of currency differentials, U.S. mills thus make more money per ton of product than do Canadian mills, and should the Canadian dollar once again approach its traditional approximate parity with the U.S. dollar, most observers agree a substantial portion of the Canadian industry would find its profits would fall sharply or disappear entirely. This is one of the factors behind an increasing shift to uncoated groundwood production, which one executive believes could reduce Canadian newsprint capacity by one million tons by the middle of the decade compared with where it was in 1982.

Upgrading capacity. While upgrading newsprint machines to make groundwood specialties is an obvious answer at first glance, there are some possible problems involved. Indeed, an upgrade can prove to be a bad idea if certain preconditions don't exist.

Jaakko Pöyry International Oy's Magnus Diesen told *Pulp & Paper*'s First Uncoated Groundwood Papers Conference, held in November 1983, that the three major opportunities in upgrading are a change in basis weight, increased brightness and improved finish.

To cut basis weight, a mill will need to produce a cleaner, lower-freeness mechanical pulp. Chemical pulp content will have to be increased to boost strength. A machine with an open draw could also face runability problems in low-basis weight paper, Diesen noted.

Depending on the quality and brightness of the raw material, a change may have to be instituted in the bleaching process. Hydrosulfite bleaching may be adequate with some fiber, but with southern pine it may be necessary to switch to peroxide bleaching, according to Diesen. This raises capital and operating costs. With borderline-quality wood it may be possible to sort the better wood out for groundwood specialties production, reserving the lower-quality wood for chemical pulp or newsprint production.

It may also be necessary to separate the groundwood machine's stock and whitewater systems from the rest of the mill to retain high brightness, Diesen added.

If the mill chooses to upgrade its finish by adding a supercalender, Diesen said it will probably want to sort the wood in the woodyard in order to bring the fresher and whiter wood over for the SC machine. Low-freeness pulp is also particularly important for SC paper, and careful screening is a must.

Diesen noted that "most SC paper mills run with two supercalenders, which may cause layout problems in an

NORTH AMERICAN NEWSPRINT INVENTORY TRENDS

(000 metric tons)

Year	Consumption (U.S.)	Year-end stocks held by all U.S. consumers	Days of supply held at year's end by U.S. consumers	Year-end stocks held by all mills in North America
1983p	11,677	1,316	43	441
1982	11,150	1,399	47	358
1981	11,204	1,628	56	255
1980	11,120	1,202	42	205
1979	11,242	967	34	196
1978	10,887	1,069	38	225
1977	10,229	1,181	43	316
1976	9,611	1,333	52	327
1975	9,254	1,004	44	116
1974	10,283	1,170	48	166
1973	10,362	834	32	217
1972	9,941	735	26	278
1971	9,220	976	38	373

p = Preliminary.
Source: Canadian Pulp & Paper Assn.

existing mill." Winding becomes particularly critical "because of the high specific weight of SC paper," and "an old newsprint machine generally cannot cope with SC paper because of the quality characteristics of this grade and because of the large roll dimensions," he continued.

Troubled Canadian industry. An important factor hurting the Canadian industry in the last 10 to 15 years has been the perception in the minds of the U.S. newspaper publisher that Canadian suppliers are less reliable than U.S. mills. The major factor contributing to this perception is the frequency and length of Canadian mill strikes, which tend to shut down much of the Canadian industry at a time because of region-wide bargaining—while U.S. mills bargain on a mill-by-mill basis or in small groupings of mills.

For example, an industry lockout followed by a brief strike halted production in British Columbia for two months in early 1984, heading right into a tough bargaining season in eastern Canada. Thus inventory-building became a major factor in publishers' buying patterns during that year, leading some to sign long-term contracts with Scandinavian producers.

Long-term trends, plus high Canadian labor costs and uncertain provincial and federal policies on foreign investment in Canada, had discouraged some Canadian companies from adding capacity in the late 1970s, although the currency exchange shift in Canada's favor finally induced a number of Canadian mills to begin planning new machines as the 1980s began. Unfortunately, this happened as the U.S. was on a capacity expansion binge, and by 1982—a recession year, to boot—there was believed to be a capacity surplus in North America in excess of 2 million tpy. By one estimate, there were at that time 2 million tpy of capacity in Canada alone represented by old-fashioned open-draw machines of less than 200 tpd—possibly prime candidates for shutdown.

Much of the new U.S. capacity is positioned in

GROWTH OF NORTH AMERICAN CAPACITY BY AREA

(000 short tons)

U.S.

Year	Northwest/ Midwest	U.S. South	West	Total
1985p	2	13	29	44
1984p	0	182	17	198
1983	0	23	76	99
1982	23	19	157	198
1981	−45	321	309	584
1980	26	466	181	672
1979	−67	137	40	109
1978	−14	6	30	21
1977	—	36	18	54
1976	−10	24	51	65
1975	17	150	60	226

CANADA

Year	Quebec	Ont./ Man.	B.C.	Atlantic	Total
1985p	50	22	−22	17	66
1984p	−6	44	33	55	127
1983	22	77	154	−72	182
1982	94	−6	298	105	491
1981	206	0	97	94	397
1980	63	14	−47	44	74
1979	−13	57	28	18	89
1978	−36	33	−17	19	−1
1977	53	−78	11	−4	−19
1976	68	−49	−13	22	29
1975	107	−3	8	−29	83

p = Preliminary.

Source: Canadian Pulp & Paper Assn., *Newsprint Data*

NEW NORTH AMERICAN NEWSPRINT MACHINES IN 1980s

Company	Location	Capacity	Startup
Bear Island Paper	Doswell, Va.	175	1980
Boise Southern	DeRidder, La.	192	1980
Macmillan Bloedel	Powell River, B.C.	176	1981
Publishers Paper	Newberg, Ore.	210	1981
North Pacific	Longview, Wash.	210	1981
B.C. For. Prod.	Crofton, B.C.	193	1982
Crown Forest	Campbell River, B.C.	193	1982
Donohue-Normick	Amos, Que.	175	1982
Ontario Paper	Thorold, Ont.	171	1982
Ontario Paper	Thorold, Ont.	171	1982
Abitibi-Price	Iroquois Falls, Ont.	209	1983
Abitibi/Augusta News	Augusta, Ga.	226	1983

Source: PULP & PAPER PROJECT REPORT.

regions where Canadian mills cannot compete economically with the added U.S. machines. The southern states have been a focus of expansion by U.S. mills, and Abitibi-Price Inc. reacted in the early 1980s by shifting a large portion of its budget for capacity expansion to its Augusta, Ga., mill.

Canadian mills lost market share in the southern and western states in the 1970s, according to a study done for the American Newspaper Publishers Assn. by Dr. Jon Udell. The Udell study showed that between 1969 and 1979, Canadian shipments to the South rose by 17.2%, while total shipments to that region were going up 31.2%—and shipments from U.S. mills, especially from the South itself, were shooting up 46.0%. U.S. mills captured 66.6% of the southern market in 1979, up from 59.8% in 1969, while Canada slipped from 36.4% to 32.5%.

In the West the picture was less dramatic, partly because eastern Canadian mills saw their market share in the West jump from less than 1% to 7.2%. But even in that region the U.S. market share rose to 49.9% from 48.2%, while the Canadian share dropped to 44.8% from 50.7%.

Only in the North Central region did U.S. market share fall—to 15.2% from 17.2%. In the Northeast, both U.S. and Canada gained market share slightly, at the expense of overseas imports.

While Canadian mills were gaining in market share in the Northeast and North Central states, however, circulations of daily newspapers in those regions were shrinking—by 9.1% and 0.7% respectively—giving Canada a bigger piece of a smaller pie. By contrast, circulations of daily papers in the South were jumping by 31.2% and those in the West by 27.6%.

A later Udell study showed that eastern Canadian mill shipments to the U.S. rose just 2.9% between 1971 and 1981, and shipments by western Canadian mills actually fell 5.9%. In that time, southern U.S. mills shipped 54.6% more paper to the U.S., and western producers upped their shipments by 51.4%.

That 1969-79 period also showed a shift toward newspapers in the small- and medium-sized cities that dominate the Sunbelt, while the big city papers of the nation were losing circulation. Daily circulation in cities of less than 100,000 in population rose by 17.1%, while circulation in cities of 500,000 or greater fell by 14.4%. If those demographic trends continue, an even further erosion of Canadian market share will occur in the market that makes or breaks the Canadian newsprint industry.

Going into the mid-1980s, Canadian mills also increasingly had to contend with Scandinavian producers determined to regain market share lost when the tight market of the mid-1970s forced a partial pullout by Scandinavian mills that chose to protect their customers in Europe at the expense of North American publishers.

The long-term impacts of that pullout were considerable, and for almost a decade, publishers in the eastern U.S. wouldn't even look at European paper. But the prolonged British Columbia lockout of 1984, combined with publisher resistance to repeated price increase attempts in the early 1980s, was a real boon to the Scandinavians.

In 1983 the U.S. imported 74,000 tons of offshore paper, all but a few hundred tons of it from Norway, Finland and Sweden. That number was up from 46,000 tons the year before and was expected to climb to 150,000 tons in 1984.

But more important for the Canadians than the absolute volume was the nature of the markets targeted by foreign competitors: most of that paper came into West Coast ports, hurting British Columbian mills that were already worried by overcapacity in the region. All of the 33,000 tons shipped into the U.S. by Norway in 1983 went to the West Coast, and 56% of Finland's 17,106 tons of U.S. shipments went to that region. Sweden shipped 53% of its 20,390 tons of paper to western ports, and another 7,293 tons went to Houston, Texas.

U.S. NEWSPRINT CAPACITY AND PRODUCTION

(000 short tons)

Year	Capacity	Production	Operating rate
30-lb weight			
1985p	5,994	—	—
1984p	5,955	—	—
1983	5,752	5,167	87%
1982	5,654	5,042	86
1981	5,457	5,239	94
1980	4,836	4,672	94
1979	4,199	4,062	95
1978	4,104	3,768	92
1977	4,069	3,871	95
1976	4,014	3,736	94
1975	3,848	3,691	92
1974	3,722	3,561	93
32-lb weight			
1974*	3,889	3,690	93
1973	3,819	3,738	96
1972	3,694	3,656	98
1971	3,642	3,476	95
1970	3,533	3,464	98
1969	3,374	3,362	100
1968	3,176	3,045	96
1967	2,844	2,709	95
1966	2,545	2,483	98
1965	2,372	2,245	95

p = Preliminary.
* Adjusted to 32-lb equivalent basis weight.

Source: Canadian Pulp & Paper Assn. and American Paper Institute.

Of course, these numbers are not large in the context of a region that in 1983 was consuming more than 1.9 million tons of paper. Much of these shipments' impact on the market in 1984 was undoubtedly psychological—an element in the never-ending competition between mill and publisher.

Not all the long-term news is bad. Western Canadian mills added enough capacity in the early 1980s to support a large jump in demand in the western U.S., should one develop. Even though Canadian mills are losing market share, they will still enjoy a growing market if the Sunbelt continues to expand as it has in the past. Despite stagnation in the early 1980s in the West, most observers expect newspapers in the West and South to continue to lead the nation.

The Udell study showed that during the 1971-81 period, in fact, western newspapers boosted their newsprint demand by 33.6%, while southern publishers

U.S. CONSUMPTION OF NEWSPRINT

(000 short tons)

Year	Consumption	Shipments from: U.S.	Canada	Europe	Consumer[1] stocks
30-lb weight					
1983p	11,677	4,860	6,650	82	1,316
1982	11,150	4,686	6,188	46	1,399
1981	11,204	4,907	6,682	41	1,628
1980	11,120	4,473	6,744	138	1,202
1979	11,240	3,970	7,023	146	967
1978	10,872	3,674	7.102	0	1,070
1977	10,232	3,737	6,341	0	1,181
1976	9,611	3,632	6,251	57	1,333
1975	9,254	3,566	5,489	33	1,004
1974	10,284	3,457	6,949	213	1,170
32-lb weight					
1974*	10,685	3,582	7,239	213	1,248
1973	10,794	3,657	6,855	381	782
1972	10,547	3,549	6,430	328	784
1971	9,835	3,307	6,146	317	1,041
1970	9,706	3,316	6,163	314	1,110
1969	9,855	3,246	6,431	293	1,017
1968	9,327	2,944	6,107	284	894
1967	9,238	2,612	6,263	283	885

p = Preliminary.

* Adjusted to 32-lb equivalent basis weight.

1. Based on data from American Newspaper Publishers Assn.

Source: Canadian Pulp & Paper Assn.

U.S. NEWSPRINT DEMAND TRENDS BY REGION

(000 metric tons)

Region	1969	1979	% change 1969-79	1983	% change 1979-83
Northeast	2,035	1,850	−9.1	1,957	5.8
North Central	1,928	1,915	−0.7	1,743	9.0
South	1,755	2,302	31.2	2,543	10.5
West	1,335	1,704	27.6	1,767	3.7

Source: "The Future of U.S. Newspapers and Newsprint Consumption," by Dr. Jon Udell, for American Newspaper Publishers Assn.; and ANPA figures.

were increasing their consumption by 29.3%. The news for eastern Canadian mills was not so good, however, with newsprint usage by northeastern papers off 3.3% and by North Central papers off 5%.

Another important factor in the health of the North American newsprint industry in the early 1980s was the rise of the insert and the preprint. Udell expects nondaily newspaper usage to grow at a faster pace than daily newspaper use through the 1980s, boosting its present 23% share of total newsprint demand. And the pattern of the last ten years would certainly support that: the Newspaper Advertising Bureau estimates newspaper insert and preprint volume rose from 12.8 million pieces in 1973 to 29.97 million pieces in 1982.

OUTLOOK

Newsprint mills in the U.S. and Canada were struggling to rebound in 1984 from the effects of two recessions in a little over two years. Canadian operating rates fell to 82% in 1982 from 94% the year before and edged back up to just 84% the next year. U.S. mills ran at 98% of capacity in 1981 and 86% in 1982 before climbing back to a less-than-resounding 87% in 1983. Rates were expected to climb back up to the low 90s in the U.S. and to show little improvement in Canada.

Most of this gloomy outlook is due to the surplus of capacity in the world. In fact, U.S. consumption jumped 4.7% in 1983, led by a 6.2% rise in the South (vs an increase of 3.6% in the Northeast, 2.4% in the North Central states and just 1.4% in the West). Unfortunately, publishers had more capacity to choose from and also reduced inventories during 1983 by 75,000 tons, to just 1.3 million short tons at the end of December 1983. This represented just 43 days of supply, compared with 47 days in December 1982.

On the other hand, that level was up three days from the end of November 1983, as publishers in the West began building stocks in anticipation of a possible shutdown of British Columbian production. Canadian mills ran at 95% in November and 88% in December 1983, a respectable figure for the holiday month and a decided improvement over the 71% of December 1982.

Then the British Columbia industry locked out its mill workers. Publishers shifted paper from eastern

U.S. PRICES FOR NEWSPRINT

(delivered in eastern U.S.)
($/short ton)

1984	
2nd quarter	$454
1st quarter	454
1983	454
1982	425
1981	453
1980	400/426
1979*	375
1978	320
1977	300
1976	285
1975	258
1974	229
1973	182
1972	164
1971	158
1970	150

* Data for 1970-79 from PULP & PAPER WEEK DATABOOK; subsequent data from PULP & PAPER PRICEBOOK.

OVERSEAS NEWSPRINT SHIPMENTS TO U.S. IN 1983

(short tons)

Country	Port of entry	Volume
Finland	Los Angeles, Calif.	9,500
	Philadelphia, Pa.	7,200
	Other	400
Mexico	St. Albans, Vt.	800
Norway	Los Angeles, Calif.	10,600
	San Francisco, Calif.	22,400
	Other	150
Sweden	Baltimore, Md.	800
	Houston, Texas	7,300
	Los Angeles, Calif.	7,200
	New York, N.Y.	1,400
	San Diego, Calif.	3,000
	Other	700
Other	Miscellaneous	3,600
Total		74,200*

* May not add due to rounding.

Source: PULP & PAPER WEEK.

TOP FIVE KNOWN[1] U.S. NEWSPRINT USERS

(000 metric tons)

	1982	1978
Knight-Ridder	572	550
Gannett	375	307
Times-Mirror	*	*
New York Times[2]	280	203
Washington Post[3]	200	144

* Quantity unknown but believed to approach Gannett.
1. Unknown but believed to approach top five level: Tribune Co.
2. Data for 1981; 1982 not available. Data for N.Y. Times newspaper only. Company's other newspapers use a further 50,000 tpy.
3. Data for newspaper named only; subsidiaries not included.

Source: PULP & PAPER estimates.

warehouses and also used up western inventories while buying paper from eastern and European mills to fill in the gaps. By the end of the lockout some small publishers were beginning to feel pinched, but newspaper industry cooperation prevented anyone from suffering unduly.

A price increase to $535/metric ton was announced for July 1, taking advantage of the labor situation and the anticipation of a tough bargaining session in the East during the summer, but it was clear that western tonnage would be moved east by publishers trying to get around that price hike. Still, inventory building began in the East in the spring as a hedge against a possible eastern strike, just as it was starting in the West to rebuild stocks after the western lockout—effectively giving the entire North American industry an excellent second quarter.

The long-term outlook in the U.S. is for a gradual tightening as a lack of new capacity finally begins to coincide with continued strength in demand. Jones Heward & Co. analyst Brian Topp predicted in April 1984 that the July 1 price hike would be followed by a second increase in the East in the fourth quarter.

St. Regis's vice president James Bowersock predicted a U.S. demand increase of 5.5% in 1984, to about 12.2 million short tons, while a more cautious H.L. Martin of British Columbia Forest Products Ltd. saw demand rising to just 11.9 million tons.

Demand should rise at a slower pace in 1985, but minimal capacity additions will keep operating rates up in the low 90s in the U.S. and should bring them to that range in Canada. But the Canadian industry appears to face the possibility of chronic overcapacity due to its reduced market share in all its major export markets—the U.S., Europe and the Far East.

Over the longer term, Udell of American Newspaper Publishers projected that total U.S. newsprint consumption will reach between 12.7 million and 14.1

CANADIAN CAPACITY, PRODUCTION AND SHIPMENTS OF NEWSPRINT

(000 short tons)

Year	Capacity[1]	Production	Operating rate	Change in capacity	Change in production	Shipments
30-lb weight						
1985e	11,326	—	—	66	—	—
1984e	11,260	—	—	127	—	—
1983	11,133	9,354	84	182	407	9,305
1982	10,951	8,947	82	540	−914	8,899
1981	10,411	9,861	94	347	354	9,829
1980	10,064	9,507	94	77	−144	9,504
1979	9,987	9,651	97	126	−62	9,677
1978	9,861	9,713	98	−41	725	9,792
1977	9,902	8,988	91	−19	73	9,005
1976	9,921	8,915	90	29	1,236	8,712
1975	9,892	7,697	78	−146	−1,869	7,728
1974	10,038	9,548	95	—	—	9,597
32-lb weight						
1974[2]	10,474	9,946	95%	137	806	9,998
1973	10,337	9,140	88	37	320	9,199
1972	10,300	8,820	86	60	365	8,901
1971	10,240	8,455	83	395	−264	8,362
1970	9,845	8,719	89	170	−99	8,704
1969	9,675	8,818	91	20	787	8,797
1968	9,655	8,031	83	361	−20	8,096
1967	9,294	8,051	87	416	−368	7,968
1966	8,878	8,419	95	457	699	8,385
1965	8,421	7,720	92	147	419	7,747

e = Estimate.

1. Tonnage data for 1965-74 are based on 32-lb weight newsprint; those for 1974-77 are measured in terms of 30-lb basis weight.

2. Adjusted to 32-lb equivalent basis weight.

Source: Canadian Pulp & Paper Assn.

NEWSPRINT EXPORTS FROM MAJOR PRODUCING COUNTRIES IN 1983

(000 metric tons)

Importer			**Exporter**		
EUROPE	**USA**	**Canada**	**Sweden**	**Finland**	**Norway**
Belgium	-	14	34	38	28
Denmark	-	-	59	91	22
France	-	5	105	146	55
Germany, Fed. Rep.	-	73	275	184	103
Greece	-	-	7	29	18
Ireland	-	10	17	15	13
Italy	-	10	30	22	13
Netherlands	-	27	95	60	55
Portugal	-	5	4	15	8
Spain	-	11	24	26	25
Sweden	-	10	-	2	-
United Kingdom	-	503	197	395	95
Other	1	-	7	70	13
Total Europe	**1**	**657**	**854**	**1,093**	**448**
NORTH AMERICA					
Canada	4	-	-	0	-
United States	-	6,045	30	115	33
Total North America	**4**	**6,045**	**30**	**115**	**33**
ASIA/AUSTRALASIA					
Australia	-	39	1	56	-
China	-	14	4	-	3
Hong Kong	7	28	8	2	2
India	-	38	5	12	4
Indonesia	11	44	15	2	3
Iran	-	-	9	15	-
Japan	164	19	2	2	-
Malaysia	6	35	3	3	11*
Singapore	14	15	9	5	*
Taiwan	10	24	3	3	-
Thailand	-	11	21	3	34
Other	4	22	63	75	27
Total Asia/Australasia	**216**	**292**	**143**	**178**	**84**
LATIN AMERICA					
Argentina	-	1	1	2	-
Brazil	-	78	13	15	1
Colombia	3	57	1	7	-
Costa Rica	1	9	-	0	-
Dominican Rep.	-	9	-	-	-
Ecuador	-	23	-	-	-
El Salvador	1	14	-	-	-
Guatemala	1	8	1	-	-
Mexico	19	19	1	-	-
Peru	2	18	-	1	-
Puerto Rico	-	45	-	-	-
Trinidad & Tobago	-	11	-	0	-
Venezuela	13	108	4	13	-
Other	4	27	1	1	-
Total Latin America	**42**	**427**	**21**	**39**	**1**
AFRICA					
Egypt	-	36	9	30	-
Nigeria	-	8	10	5	8
Other	-	-	20	7	11
Total Africa	**-**	**42**	**39**	**42**	**19**
WORLD TOTAL	**267**	**7,475**	**1,087**	**1,467**	**585**

*Malaysia and Singapore combined.

Source: PULP & PAPER INTERNATIONAL, Annual Review, August 1984.

WORLD DEMAND FOR NEWSPRINT

(000 short tons)

Year	North America	Western Europe	Asia and Oceania	Eastern Europe	Africa & L. America	Total
1982p	11,949*	5,747	6.193	1,823	1,751	27,462
1981	12,781	6,008	6,576	1,844	2,103	29,312
1980	12,434	6,080	6,231	1,815	1,818	28,379
1979	12,208	5,755	6,065	1,867	1,651	27,546
1978	11,795	5,459	5,728	1,855	1,512	26,349
1977	10,984	5,160	5,373	1,890	1,626	25,033
1976	10,826	5,650	4,476	1,867	1,379	24,193
1975	9,953	5,385	4,335	1,841	1,375	22,889
1974	11,505	6,197	4,048	1,778	1,497	25,025
1973	11,752	6,059	3,799	1,689	1,393	24,692
1972	11,088	5,622	3,735	1,663	1,427	23,535
1971	10,491	5,488	3,597	1,617	1,416	22,609
1970	10,510	5,808	3,498	1,563	1,597	22,976
1969	10,679	5,636	3,261	1,474	1,430	22,480
1968	10,009	5,019	2,860	1,393	1,305	20,586
1967	9,796	4,654	2,596	1,323	1,195	19,564
1966	9,918	4,871	2,289	1,207	1,086	19,371

p = Preliminary.

* Actual.

1. Figures prior to 1974 do not include People's Rep. of China.

Source: Canadian Pulp & Paper Assn., *Newsprint Data.*

WORLD CAPACITY FOR NEWSPRINT

(000 short tons)

Year	Canada	U.S.	Western Europe	Asia and Oceania	Eastern Europe	Africa & L. America	Total
1983p	11,133	5,754	7,766	6,189	2,640	1,301	34,783
1982	10,951	5,655	7,375	6,189	2,640	1,241	34,051
1981	10,461	5,456	6,950	5,820	2,640	1,103	32,430
1980	10,064	4,872	6,966	5,512	2,596	1,059	31,069
1979	9,992	4,200	6,818	5,324	2,425	916	29,675
1978	9,899	4,090	5,542	5,197	2,309	783	28,820
1977[1]	9,902	4,069	6,134	4,993	2,177	755	28,030
1976	9,921	4,014	6,055	4,201	2,078	679	26,948
1975	9,892	3,948	6,145	3,960	2,078	616	26,424
1974[2]	10,038	3,722	6,246	3,829	1,964	595	26,009
1973	10,337	3,819	6,505	3,223	1,974	592	26,450
1972	10,300	3,694	6,366	3,187	1,866	509	25,922
1971	10,240	3,642	6,408	2,925	1,864	465	25,543
1970	9,845	3,533	6,465	2,989	1,863	469	25,164

p = Preliminary.

1. People's Rep. of China capacity revised for 1977 and on.

2. Figures prior to 1974 do not include People's Rep. of China.

Source: Canadian Pulp & Paper Assn., *Newsprint Data.*

million short tons by 1990. Most observers expect that Canadian consumption will reach only about 1.3 million short tons in 1985, which—combined with loss of market share in the U.S. and North American capacity increases during the first half of the decade—means Canadian mills will have to seek significantly increased overseas markets to keep busy. And that will be a challenge.

Overseas markets. Canadian and U.S. mills appeared to be losing market share in Latin America, and Canadian producers had problems in Asia as well in 1983 and 1984, as paper from Scandinavia and South Africa competed effectively in both markets, and the Japanese, Chileans and Koreans also cut prices aggressively in Asia and the Pacific.

Canadian offshore shipments in 1983 dropped 5.8% from 1982 (and were down 20.6% from 1981), with the most pain coming from the important European market where shipments by Canadian mills slipped 6.4%. Shipments to the smaller Latin American market fell by 9.1% in 1983 and to Oceania by 13.5%. Canadian mills were able to boost sales to Asia by 2.3%, however, although U.S. and Scandinavian producers appeared to be making bigger gains in this traditional dumping ground of excess tonnage.

The biggest problem for Canada is in Western Europe where traditional shipments in the 600,000-metric-tpy to 800,000-metric-tpy range are threatened by the European Economic Community's imposition on Jan. 1, 1984, of a quota of just 500,000 tpy of duty-free Canadian newsprint. If Canadian efforts to resolve the situation through the General Agreement on Tariffs & Trade and directly through the EEC Commission fail, Canada's European customers will have to pay a duty on any paper imported over the limit—something that would force more and more European publishers to buy their paper from the Scandinavians, who are subject to no quota limits.

European publishers don't like the idea of losing freedom of choice in suppliers and are supporting the Canadian side in this issue. An increase in the Canadian quota is expected before the end of 1984, but the ultimate size of the quota is of some importance to the long-term health of exporting Canadian mills.

While Scandinavian mills were getting inside the EEC tariff wall on Jan. 1, 1984, they were also taking advantage of their currency devaluations of recent years to ride out a price war in Latin America and the Far East.

At one point in late 1983, spot market paper in places like Indonesia and Singapore was going for as little as $365/metric ton (delivered), compared with a list of $420. This kind of discounting was not being pushed primarily by the Scandinavians, Australians, New Zealanders or established North Americans, but rather by South Africans, Chileans, Japanese, Koreans and those North American producers who don't normally sell a lot of paper in those markets.

And with world capacity expected to remain seriously in excess for the next several years—South Africa's SAPPI Ltd. brought on a new 140,000-tpy machine in September 1983 that was going to make 50,000 tons for the Far East and Latin America in 1984, for example—this situation is not expected to change soon.

One of the most interesting developments in the newsprint industry in recent years was the 1983 acquisition by Fletcher Challenge Ltd. of Crown Zellerbach Corp.'s Canadian assets, since renamed Crown Forest Industries Ltd. Although CFI is being operated as a separate entity from FCL's New Zealand-

AVERAGE COSTS OF PRODUCING NEWPRINT[1]

(U.S.$/short ton)

	CANADA				U.S.			
	British Columbia		Eastern		South		Northwest	
	$/ton	%	$/ton	%	$/ton	%	$/ton	%
Wood	$ 80	21.5%	$112	28.2%	$ 70	18.4%	$ 95	22.4%
Energy	58	15.6	56	14.1	95	25.0	102	24.1
Chemicals	13	3.5	10	2.5	20	5.3	15	3.5
Materials[2]	46	12.4	33	8.3	45	11.8	42	9.9
Labor	67	18.0	89	22.4	55	14.5	58	13.7
Transportation	65	17.5	60	15.1	25	6.6	40	9.4
Administration	15	4.0	22	5.5	30	7.9	30	7.1
Depreciation	28	7.5	15	3.8	38	10.0	40	9.4
TOTAL	$372		$397		$380		$424	

1. Estimated 1983 costs.
2. About evenly split between maintenance materials and operating supplies.
Source: PULP & PAPER estimates.

based Tasman Pulp & Paper Co. Ltd., this purchase signaled the arrival of FCL as a major international newsprint supplier.

More examples of companies in small countries buying or building mills in North America may recur in the coming years. Stora Kopparberg Group has expressed an interest in building a multimachine newsprint mill in South Carolina, and a European company was rumored in 1984 to be looking at the possible purchase of International Paper Co.'s Pine Bluff, Ark., newsprint facility.

SHARE OF ADVERTISING REVENUE RECEIVED BY NEWSPAPERS AND MAGAZINES

	1983		1972		1978		1970	
	$million	%	$million	%	$million	%	$million	%
Daily newspaper	20,582	27.1	17,694	26.6	12,690	29.0	5,745	29.3
Magazines	4,233	5.6	3,710	5.6	2,595	5.9	1,323	6.8
Television	16,136	21.3	14,329	21.5	8,850	20.2	3,665	18.7
Radio	5,210	6.9	4,670	7.0	2,995	6.8	1,278	6.5
Direct mail	11,795	15.6	10,319	15.5	6,030	13.8	2,734	13.9
Business publications	1,990	2.6	1,876	2.8	1,420	3.2	740	3.8
Outdoor	794	1.0	721	1.1	465	1.1	234	1.2
Others	15,110	19.9	13,261	19.9	8,735	20.0	3,881	19.8
Total	75,850		66,580		43,740		19,600	

Source: McCann-Erickson Inc.

UNCOATED GROUNDWOOD

GRADE STRUCTURE

Uncoated groundwood papers are similar to newsprint in terms of physical properties but are manufactured to have better printing characteristics and are priced above standard newsprint. They are used mainly as an intermediate printing paper between newsprint and coated paper, with the exception of the small (300,000 tpy) groundwood forms paper sector which competes with uncoated free-sheet forms bond.

Brightness is one distinguishing characteristic between uncoated groundwood sheets and competing products. Newsprint brightness ranges from 56 to 62 Elrepho, whereas uncoated groundwood grades start at about 64 and may go as high as 68 or even 70 in the case of products such as the supercalendered grade. These ratings are below those of coated groundwood, which are in the low to medium 70s, and uncoated groundwood is considered to be below coated groundwood in overall printing qualities. It does offer better endurance and a better printing surface than newsprint, however.

Most existing uncoated groundwood machines originally made newsprint and then were upgraded to production of groundwood specialties when they ceased to be economical competitors in the newsprint industry. This trend is expected to accelerate significantly in the mid-1980s due to overcapacity in newsprint, plus increasing customer demands for improved appearance characteristics. Methods of upgrading a newsprint machine's output to uncoated groundwood include the addition of fillers, use of more chemical furnish and additional on-machine calendering, or supercalendering off-machine. Any number of difficulties exist for newsprint mills wanting to make such an upgrade, however, and in many cases, such a conversion may not prove economical (see discussion in newsprint chapter).

Several Canadian newsprint manufacturers are in the process of ordering or are considering ordering supercalenders for newsprint machines in order to produce SC papers of various qualities to compete with a recent surge in SC paper capacity in North America and Europe: At a spring 1984 publishing meeting, delegates counted as many as ten possible installations of new supercalenders in North America, including a possible greenfield mill in Canada and supercalenders under study for installation in newsprint mills as well as coated paper mills.

One U.S. SC mill sometimes makes a rotonews sheet that gets clay content from the broke from an adjacent SC machine. Other methods of making uncoated groundwood papers that meet demands of specific end-use markets vary so widely that observers say the industry is becoming increasingly fragmented, which a

STATISTICS FOR UNCOATED GROUNDWOOD PAPER*

	1982	1983	1984e
UNITED STATES			
Production, 000 tons	1,471	1,531	1,610
Capacity[1], 000 tons	1,749	1,755	1,733
Utilization rate, %	84.1	87.2	92.9
Imports, 000 tons	653	920	950
Exports, 000 tons	56	38	30
Apparent U.S. consumption			
000 tons	2,068	2,413	2,530
lb/capita	17.89	20.68	21.49
000 tons/$ billion real GNP (1972)	1.39	1.57	1.58
CANADA[2]			
Production, 000 tons	715	843	890
Capacity, 000 tons	865	882	926
Exports, 000 tons	602	701	770

* All tons are short tons.
e = Estimate.
1. PULP & PAPER estimate.
2. Canadian Pulp & Paper Assn.

few observers believe could eventually hurt product identity and pricing structures and thus the ability of some mills to compete.

Typical end uses for uncoated groundwood, with approximate North American demand estimates (official statistics are not published), are: catalog, 700,000 tpy of uncoated groundwood; directory, 450,000 tpy; newspaper insert and direct mail advertising circular, 600,000 tpy; periodical (magazine and Sunday supplement), 1.0 million tpy; some business papers, including forms and carbonless basestock, 330,000 tpy; and miscellaneous end uses including books, basestock for converting into various products and export, in excess of 200,000 tpy. Basis weight range is normally 18 to 40 lb (24 × 36 in., 500 sheets) or 30 to 66 g/m².

Catalog paper is consumed by major retailers such as Sears, Roebuck & Co., J.C. Penney and Montgomery Ward & Co., along with a host of specialty stores, mail-order houses and other merchandisers. A Strategic Futures Inc. study estimated that in 1982, 283,000 tpy of all kinds of papers were used by the major catalog merchandisers—primarily Sears, Penney, Ward, Spiegel and Alden—to produce catalogs, with another 321,000 tpy going to specialty catalog mail-order firms and 322,000 tpy going to retail merchandisers. Out of the total U.S. catalog market of 1.435 million tpy, SFI estimated 27% was uncoated, 41% was coated No. 5 and 32% was coated Nos. 3 and 4.

Catalog paper is made for rotogravure printing and for offset printing, with gravure printing favored for longer runs because of its economic advantages. Catalog paper is generally of higher quality than directory paper; in fact, quality is such a sufficiently significant consideration that a large number of catalog publishers have introduced some lightweight coated paper into their publications to enhance appearance. Traditional catalog paper has also suffered from competition from SC paper—again, for reasons of enhanced appearance.

UNCOATED GROUNDWOOD PAPERS TYPICAL GRADE STRUCTURE

Grade	Basis weight[1]
Rotogravure[2] (standard, premium, high brightness)	33, 35 lb (25 x 38 in., 500 sheets)
Offset[2] (premium, high brightness)	28, 35, 38 45 lb (25 x 38 in., 500 sheets)
Magazine (gravure, offset)	35 lb (25 x 38 in., 500 sheets)
Paperback/book	35, 37 lb (25 x 38 in., 500 sheets)
Directory (white, yellow)	20, 22.5 lb (24 x 36 in., 500 sheets)
Computer	15, 18 lb (17 x 22 in., 500 sheets)

1. Typical weights offered by producers. Other weights may be available.
2. Catalog grades.

Directory paper, such as telephone directory stock, has a lower gloss and brightness than catalog paper and for telephone books is generally made in the 22- to 23-lb basis weight range. American Telephone & Telegraph Co. is believed to consume upward of 350,000 tpy of all directory paper used in the U.S. and General Telephone Directory Co. another 40,000 tpy, with other phone companies and other directory producers using the balance.

By the estimate of Marjatta Malmipohja of the Finnish Paper Mills Assn., in an address to *Pulp & Paper*'s First Uncoated Groundwood Papers Conference in November 1983, world consumption of lightweight telephone directory-type paper in 1982 was about 1.1 million metric tons, with about 600,000 tons of that being used in North America, 300,000 tons in Western Europe and 200,000 tons in other regions.

The newest force in uncoated groundwood markets has been supercalendered paper, either in the "SC magazine paper" range occupied by the major SC producers—Madison Paper Corp. (with 165,000 tpy of capacity devoted to SC paper) and St. Regis Paper Corp. (with about 120,000 tpy)—or in the "SC newsprint" area occupied by an increasing number of newsprint machines getting supercalenders to produce slightly upgraded newsprint paper. The term SC magazine paper is sometimes used to indicate a sheet that would be used in Europe for magazines or in North America for an increasing number of Sunday newspaper supplement magazines because it has an apparent surface similar to coated No. 5 papers, while the SC newsprint sheet is a lower-quality, lower priced product.

SC papers have been used extensively for years in Europe in magazines, and St. Regis has had some success over the years in selling SC magazine paper to

GPO MINIMUM ACCEPTABLE PROPERTIES FOR GROUNDWOOD PAPER FORMS

Basis weight				
lb*	12	15	18	20
g/m²	45	56	68	75
Burst	7	8	11	14
Opacity, %	80	80	80	80
Caliper				
0.001 in.	2.8	3.5	4.2	4.6
mm	0.071	0.089	0.109	0.117

* Ream size: 17 x 22 in., 500 sheets.

Sunday supplements such as *Parade* or *Family Weekly*. *The New York Times* has bought 30,000 tpy from Finnish mills for several years for its Sunday Supplement, but now that Madison has brought a 165,000 tpy machine online—in a mill partly owned by the New York Times Co.—the weekend publication gets half its SC paper needs from the new machine.

SC magazine-grade papers are believed currently to represent a market in North America of about 450,000 tpy. Of that, Madison makes 165,000 tons and imports from Finland and elsewhere about the same. St. Regis produces about 100,000 tpy, and miscellaneous North American mills make minor and variable amounts. At Trois Rivières, Que., CIP Inc. makes about 70,000 tpy of a supercalendered sheet, which until recently was considered to be a competitor with the SC magazine sheets of St. Regis and Madison, but market sources indicate the company is now attempting to compete more with supercalendered rotonews.

Aside from the supercalendering operation, SC papers have a clay filler content of 10% to 25% to enhance appearance. Canadian mills have a worse record in the production of filled SC sheets than European or U.S. mills, partly due to the difficulties of manufacturing such a product and also because of environmental constraints. At least two possible filled SC operations were believed to be under study in Canada in mid-1984, one at a greenfield site and another at an existing uncoated groundwood mill. Because of the reputation of Canadian SC, such operations would have to prove themselves in the market from a quality and reliability point of view. But the attractive prospects facing SC in the market, as discussed later in this chapter, may continue to interest papermakers in such investments.

The wide latitude on the part of an SC mill in terms of supercalendering and clay filler leaves a lot of room for gradations in the market. In fact, in the entire uncoated groundwood market, mills have been switching capacity to uncoated groundwood from other products at a rapid rate, and the wide variety of market and production strengths of these mills has dictated an increasing range of marketing approaches on the part of producers.

One of the newer markets for uncoated groundwood paper is groundwood forms, a market that has been growing by 15% to 35%/year in recent years. Used for computer printouts, generally for companies' internal sales documentation and reports, groundwood forms represent a low-cost alternative to free-sheet forms bond. List price differential between groundwood and free-sheet forms paper has been close to $250/ton, with a free-sheet/groundwood blend priced more or less in between.

U.S. PRODUCTION AND CAPACITY FOR UNCOATED GROUNDWOOD PAPER

(000 short tons)

	Production		
	Census	API[1]	Capacity[2]
1984	—	—	1,622
1983	n.a.	1,509	1,642
1982	1,291	1,459	1,655
1981	1,451	1,447	1,625
1980	1,538	1,498	1,624
1979	1,674	1,474	1,537
1978	1,569	1,309	1,453
1977	1,578	1,330	1,367
1976	1,550	1,294	1,309
1975	1,293	1,113	1,329
1974	1,411	1,173	1,280
1973	1,416	1,156	1,403
1972	1,308	1,106	1,442
1971	1,186	1,074	1,363
1970	1,214	1,075	1,230
1969	1,208	1,089	1,296

n.a. = Not available.

1. Shipments.

2. American Paper Institute, 1983.

UNCOATED GROUNDWOOD PAPER: U.S. EXPORTS AND IMPORTS

(000 short tons)

	Exports[1]	Imports[2]
1983	37	732
1982	56	515
1981	120	459
1980	101	488
1979	80	798
1978	58[1]	515[2]
1977	54	172
1976	71	137
1975	74	84
1974	53	110
1973	29	120
1972	18	142
1971	10	156
1970	7	218

1. Prior to 1978, Census classification was groundwood paper, printing, writing and converting, uncoated. From 1978, classification was printing and writing papers, over 10% mechanical pulp, uncoated.

2. Prior to 1978, Census classification was uncoated book and printing paper with over 25% mechanical pulp. From 1978, classification was the same except for mechanical pulp content, which was reclassified as over 10% mechanical pulp.

Source: Bureau of the Census.

In weak markets, however, such as the situation in 1981-83, discounts can erode the price advantage of blends and even of groundwood forms and thus slow the growth of the groundwood product. Also, there is some question of whether groundwood forms demand growth will slow in coming years as customer resistance to its inferior appearance compared with free sheet begins to close off further avenues for penetration into the office.

One aspect of groundwood forms bond, aside from having a lower brightness than free sheet, is its tendency to age rapidly. Forms producer Hunt Harris, president of Star Forms Inc., told *Pulp & Paper*'s First Uncoated Groundwood Papers Conference that "when reports are kept for archival purposes such as audit trails, most users prefer free-sheet papers."

Harris added, however, that "for normal reports kept for under 90 days, groundwood papers should be adequate." He also noted that "most forms buyers . . . prefer not to mix groundwood and free-sheet papers in their purchases. Even though only a few reports must be permanent, the user will generally purchase all free-sheet paper rather than bother with two inventory types." To Harris, the burden of proof, then, is on the paper producer, the forms producer, and the forms merchant to convince the market that economic value justifies exploration of groundwood forms. As he points out, the poor quality of the early groundwood forms sheets caused a stigma in the minds of the consuming public. The appearance of groundwood forms paper in tight markets when free sheet was unavailable created the impression that groundwood was "forced" on customers.

Other performance characteristics hurt the acceptability of groundwood forms as well, unless the sheet is manufactured to rigorous standards. Among the problems sometimes faced by users or converters of groundwood forms, particularly on high-speed line printers, include:

- Poor refoldability, which can slow down operations of a high-speed printer
- Lint on the surface of the sheet, which wears out printer ribbons faster than normal
- Inadequate internal strength, causing line holes to rip apart on some fast printers, leading to jamming of the printer
- Inability to punch cleanly, leaving punch holes—"chad"—in place to jam the printer
- Abrasiveness, which causes converters' line hole punches and perf blades to wear out more quickly than with free-sheet forms paper.

Harris also mentioned that inadequate cleaning and refining at the pulp mill can cause a forms printer's press plates and blankets to fill in prematurely, requiring excessive stops to clean up—a particular problem with printers that use fast flying-splice setups requiring consistent operations for the sake of cost-effectiveness. Harris cited Abitibi-Price Inc. and Consolidated-Bathurst Inc. as producers that have made the effort to manufacture an adequately clean sheet, while some competitors make a forms paper that "resembles newsprint more than the forms bond that we are used to converting."

PRODUCTION/CAPACITY

U.S. production of uncoated groundwood papers grew at a rapid rate during the 1970s but then turned downward during the prolonged economic stagnation that began in 1979 and continued into the early 1980s. American Paper Institute figures indicate shipments in 1981 fell 3.8% to 1.441 million short tons, while 1980's shipment level was another 0.7% below 1979. Shipments in 1982 rebounded, but only to 1.459 million tons, while in 1983 they returned exactly to 1979's level: 1.509 million tons. Finally, in 1984, uncoated groundwood papers appeared to be heading on to a new high, with API figures indicating first-quarter shipments running at an annual rate nearly 19% ahead of the year-earlier period.

Canadian production showed a steady rise in the early 1980s, going up 8.5% in 1980, 5.0% in 1981, 0.6% in 1982 and 17.9% in 1983, according to the Canadian

ESTIMATED CAPACITIES FOR UNCOATED GROUNDWOOD PAPER OF MAJOR COMPANIES

	Annual capacity (000 tons)		Capacity N. American market	
	U.S.	Canada	Total	%
1. Abitibi-Price Inc.	—	500	500	13.1
2. CIP	—	380	380	10.0
3. Great Northern Nekoosa	380	—	380	10.0
4. Consolidated-Bathurst Ltd.	—	370	370	9.7
5. MacMillan Bloedel	—	330	330	8.7
6. Boise Cascade Corp.	40	260	300	7.9
7. St. Regis Corp.[1,2]	220	—	220	5.8
8. Domtar Inc.	—	210	210	5.5
9. Madison Paper	200	—	200	5.2
10. Fraser	135	—	135	3.5
11. Crown Zellerbach	130	—	130	3.4
12. Kimberly-Clark Corp.	95	30	125	3.3
13. Bowater Inc.	70	—	70	1.8
14. Pejepscot Paper[3]	56	—	56	1.5

North American capacity (1984): 3.813 million tons
U.S.: 1.733; Canada, 2.080
Capacity share of top five companies: 51.4%
Capacity share of top ten companies: 79.3%

1. Includes 34,000 tpy at Hennepin Paper Co.
2. St. Regis acquired by Champion International Corp. in 1984.
3. Subsidiary of Hearst Corp.

Pulp & Paper Assn. These figures should not be taken very seriously, however, since U.S. government definitions of uncoated groundwood and newsprint for tariff purposes are wildly out of touch with reality—including rotonews in newsprint, for example. Thus, Canadian production of groundwood specialties in 1983 is listed by CPPA at 843,000 short tons, whereas a more accurate number would be something closer to 1.6 million or 1.7 million tons. Thus it is also difficult to tell for sure what real trends there have been in Canadian output.

The U.S., where little rotonews is made, is considered to have relatively accurate figures on uncoated groundwood production and capacity.

API estimates U.S. uncoated groundwood capacity in 1984 reached 1.622 million short tons, while CPPA figures show 1.157 million short tpy of Canadian capacity in that year. But *Pulp & Paper* estimates indicate more than 2.0 million tpy of Canadian capacity, and one executive cites an estimate by Strategic Futures that up to 1.1 million short tpy of "newsprint" coming into the U.S. from Canada in one recent year would actually fit into the category of uncoated groundwood, according to price or specification criteria, indicating a Canadian uncoated groundwood capacity of nearly 2.3 million tpy.

Tariff considerations are behind the unreasonably low level of CPPA figures. API figures are believed to be considerably more reflective of the real market situation. Assuming they are not far off from the truth, total North American capacity approaches 3.7 million tpy.

Official CPPA figures show an 18.6% increase in capacity between 1983 and 1984, while API shows U.S. capacity actually dropping by 1.2%. The only significant change in U.S. capacity recently was the late-1981 startup of Madison's 165,000-tpy SC machine in Madison, Maine, along with an incremental expansion of 6,500 tpy at Crown Zellerbach Corp.'s Port Angeles, Wash., mill that same year, while an estimated 58,000 tpy had been shut down or switched to other grades in 1980, with no significant expansions.

Canadian executives are looking at a number of possible upgrades, but the only ones being discussed publicly in mid-1984 were purchase of Abitibi-Price's Sault Ste.-Marie, Ont., groundwood specialties mill by

UNCOATED GROUNDWOOD PAPERS: CANADIAN PRODUCTION, EXPORTS, AND CAPACITY

(000 short tons)

	Production[1]	Exports[2]	Capacity[1]
1985	—	—	1,031
1984	—	—	926
1983	843	n.a.	882
1982	715	460	827
1981	711	320	728
1980	677	305	728
1979	625	321	702
1978	580	266	675
1977	463	193	560
1976	363	133	480
1975	315	140	402
1974	401	183	440
1973	319[3]	184	412

n.a. = Not available.
1. Canadian Pulp & Paper Assn.
2. Statistics Canada.

CANADIAN UNCOATED GROUNDWOOD PAPER EXPORTS

(short tons)

Destination	1980	1981	1982	1983
United Kingdom	9,432	7,325	—	505
Benelux	1,549	—	—	—
Hong Kong	7,484	4,285	2,867	1,226
Singapore	2,773	3,972	2,078	—
Japan	—	23	—	9,248
Philippines	1,312	1,842	1,739	—
Thailand	1,595	—	786	483
Other Asia	572	109	1,068	110
Australia	18,434	3,387	8,189	2,331
Colombia	2,101	4,087	1,571	2,752
Venezuela	—	981	—	1,217
Other Latin America	1,070	794	1,652	1,387
U.S.	258,768	292,460	439,338	556,048
Total	305,090	318,265	459,288	575,307

Source: Statistics Canada (commodity class 351-49).

a group of investors headed by entrepreneur Dan Alexander and conversion to make SC rotonews and modifications at MacMillan Bloedel Ltd.'s Powell River, B.C., mill. At Powell River, MB is rebuilding newsprint machine No. 9 to make lightweight specialty papers and is doubling capacity of high-brightness printing papers from present 86,000-short-ton levels, enabling both Nos. 6 and 7 machines to make the product at the same time. Some newsprint output is being shifted to the under-utilized Alberni mill in the plan.

OUTLOOK

Uncoated groundwood mills should be optimistic about their future in the 1980s. A variety of end-use markets should consume significantly more paper as the period progresses. But because of the intermediate status of these papers between newsprint and lightweight coated paper, the actual prospects depend as much on what other paper is available to the same end-use markets as on how much total paper will be consumed by those markets. And the capacity of competing sheets is always difficult, if not impossible, to forecast, with as many as seven coated groundwood machines believed to be under study for North America as of mid-1984, for example.

U.S. capacity of coated groundwood was expected by API to rise by only about 100,000 tons from 1984 to 1986, bringing total capacity up about 900,000 tons from 1980. Despite a huge increase, pushing capacity up by a third in just about half a decade, all that new paper has been swiftly absorbed by the market. Indeed Strategic Futures predicted in spring 1984 that a 550,000-ton shortfall in coated paper could afflict the market in 1985.

Coated groundwood and uncoated groundwood compete in several of the major paper markets, especially magazines and catalogs, but with coated paper in short supply, uncoated groundwood mills were taking up the slack. This situation was expected to continue through 1986, barring a recession in the interim. New coated groundwood capacity was expected to enter the market by early 1987, but it is too early to predict the impact of that development on uncoated groundwood.

Uncoated groundwood mills were suffering from a possibly worrisome phenomenon, however—the increased preference of catalog, insert, supplement and cents-off-coupon printers for coated paper over uncoated. That trend was partially behind the desire of uncoated paper mills to consider installing supercalenders to offset some of the move to coated, while both coated and uncoated mills may suffer from a technological innovation that makes it possible to inexpensively retrofit old newsprint machines with a coater.

Grade-shifting and the intergrade competition it implies were probably the primary hallmarks of these markets in 1984 and will probably remain so for several years to come. Uncoated groundwood mills are constantly playing catch-up in an attempt to offset the natural advantage held by coated mills. Except for situations when coated paper becomes overpriced—a possibility, in the view of some observers, for 1985—uncoated groundwood will often be the second choice for many publishing and printing end uses.

Some magazines are expected to increase their use of uncoated groundwood as cost pressures mount on small, specialized publications. Some have had to resort to uncoated groundwood simply because they couldn't get coated paper—although in the first half of 1984 uncoated groundwood was not in excessive supply. Directories will continue to consume almost nothing but uncoated groundwood paper, and most observers expect double-digit demand growth to continue in groundwood forms.

Indeed, uncoated groundwood mills could enjoy fairly healthy market conditions for several years. And with coated groundwood operating rates back up in the mid-90s and above, with healthy price increases taking effect in 1983-84 and probably in 1985, the 15% to 35% price advantage traditionally held by uncoated groundwood should reassert itself. This will strengthen

UNCOATED GROUNDWOOD EXPANSIONS

Company	Location	Annual short tons	Startup	Nature of work
Abitibi-Price	Beaupre, Que.	160,000	1983	Upgrade from news
Donohue	Clermont, Que.	40,000	1984	Upgrade from news
MacMillan Bloedel	Port Alberni, B.C.	n.a.	1984	Partial upgrade from news
MacMillan Bloedel	Powell River, B.C.	45,000	1984	Partial upgrade from news
Under discussion				
International Paper	Pine Bluff, Ark.	n.a.	n.a.	Upgrade from news

n.a. = Not available

Source: PULP & PAPER WEEK, PULP & PAPER PROJECT REPORT the position of uncoated groundwood as the low-cost alternative for catalog and magazine publishers priced out of the coated paper markets.

A strong competitor for magazine orders should be SC paper such as that produced by Madison, although a Madison marketing official told *Folio* magazine in April 1982 that few magazines had made the switch to SC so far. Those that had changed and he listed—*VFW Magazine*, *Elks Magazine* and *Guideposts*—were concentrated in the "fraternal publication" area where advertising revenues are low or nonexistent, and costs are a constant problem.

The official also indicated that *TV Guide* and *Better Homes and Gardens* were testing the paper, while a Dallas *Morning News* Sunday supplement had made the switch and the *Atlanta Constitution*'s Sunday magazine was considering a similar move. Market observers also said in 1982 that *Consumers Reports* was considering printing on SC paper.

That situation didn't change much through 1984. Indeed, Madison found that while the grade of paper it makes is called SC magazine paper in Europe, its biggest use so far seems to be for catalogs and Sunday supplements. The mills that make SC paper were running full-out in 1984, and Finland alone was expected to export 200,000 tons of SC magazine sheet to the U.S., although market pressures in Europe were expected to depress that figure in 1985.

Indeed, with European paper markets rebounding from the recessions of the early 1980s, they were demanding more and more of the paper that European mills make. It seemed possible that 1985 could be the tightest coated and uncoated groundwood paper market in many years.

One major insert producer—K-Mart—even went to Fed. Rep. Germany in the spring of 1984 to have its Mother's Day insert printed on 38-lb coated stock because it couldn't get coated paper in North America. Interestingly, uncoated groundwood didn't even figure in its calculations and, indeed, retailers that want to upgrade their image have increasingly opted for coated paper over uncoated.

By the same token, however, uncoated groundwood has benefited from a quality shift from newsprint. More and more bottom-end inserts and Sunday supplements that had resisted the move to rotonews or high-brightness offset in earlier years were finally driven into higher grades because of the demands of advertisers, competition from customers, and improved appearance of daily newspapers' run-of-paper (ROP) sections.

Major end-use markets for uncoated groundwood are expected to show fairly stable growth rates of around 5%/year for several years, and if uncoated groundwood capacity does not suffer from the kind of explosion that periodically plagues coated paper, operating rates should be respectable during the middle years of the decade.

Indeed, consumption of directory paper by some telephone companies was growing at double-digit rates during the late 1970s: General Telephone Directory (which in 1983 was buying paper at a 40,000-short-tpy rate) said its paper use rose at 15%/year for several years. But most telephone directory publishers have recently enacted paper-saving mechanisms, including less frequent publication of directories and printing of a smaller number of books. This may lead to slower

LIGHTWEIGHT (CATALOG/DIRECTORY) PAPER CAPACITIES—NORTH AMERICA

(000 metric tons)

Company	Capacity	Mill producing
GN Nekoosa	190	Millinocket, Maine
Fraser	130	Madawaska, Maine
Crown Zellerbach	130	Port Angeles, Wash.; Clatskanie, Ore.
MacMillan Bloedel	100	Port Alberni, Powell River, B.C.
Abitibi-Price	90	Beaupre, Que.
St. Regis	90	Lufkin, Tex.
Consolidated-Bathurst	70	Trois Rivières, Ville de la Baie, Que.

Source: PULP & PAPER.

UNCOATED GROUNDWOOD PAPERS: U.S. PRICE HISTORY

($/ton, year-end)

	Catalog (25-lb roto)[1]	Premium rotonews (30-lb)
1984*	$620	$540
1983	600	540
1982	551	515/520
1981	551	500/515
1980	515	475
1979	468	404
1978	425	375
1977	405	330
1976	345	n.a.
1975	320	n.a.
1974	320	n.a.
1973	200	n.a.
1972	175	n.a.

* Second-quarter announced price.

1. Prices for other grades vary but the following approximate prices existed in second quarter, 1984: (1) Directory, 22.5-lb yellow, $700/ton; (2) Directory, 22.5-lb white, $670/ton; (3) Supercalendered uncoated groundwood magazine paper, 34-lb, $690/ton.

Source: PULP & PAPER WEEK, PULP & PAPER PRICEBOOK 1984.

growth in directory paper consumption in coming years. And, in fact, consumption by telephone companies is believed to have been fairly flat since 1980. GTE Directories Corp. printing director Alan Duy told *Pulp & Paper*'s First Uncoated Groundwood Papers Conference, however, that "total printed page annual growth rates of 5% are probably conservative" in the next five years.

The long-term outlook for demand for both directory and catalog papers is clouded by the possibility of competing services being offered by electronic mechanisms. AT&T is believed to be actively considering ways of introducing an "electronic Yellow Pages" service, and the French national telephone company may be pioneering the way toward inexpensive electronic directory systems through its plan to replace all phone books with electronic terminals by 1995.

Catalog papers, too, could be affected by the advent of electronic terminals if they ever reach the home in large numbers. Recent polls of catalog publishers and other merchandisers indicate they expect to see a significant switch to electronic means eventually although probably not before the 1990s or the late 1980s at the earliest. Sears conducted a highly-publicized experiment in 1981 in the potential customer acceptance of a videodisc catalog, in which Washington, D.C.-area stores and 1,000 homes equipped with videodiscs received disc catalogs in addition to paper catalogs. A Sears official told an API meeting in late 1981 that "in our judgment, the Sears catalogs will never be completely supplanted by electronics," and added that it should be six or seven years before "the electronic revolution makes its first modest inroads into the use of paper in the catalog business." Since then, if anything, most observers would probably move that threshold forward into the 1990s.

Sears did not find its customers quick to accept the new system. But the economics of the idea seemed attractive to the company: the Sears executive estimated that 90% of the $250 million/year his company spends producing catalogs goes into printing and distribution, with the remaining 10% apparently consisting of such costs as photography and text-writing. Thus an electronic system—if there ever is one—that could cut that 90% portion substantially would attract a lot of attention among catalog publishers.

Another effect of the electronic revolution could actually help demand for uncoated groundwood paper—the explosion of office computer printers and intelligent copiers. One executive says API expects the number of high-speed electronic printers installed in the U.S. to jump by 266% between 1980 and 1985, and the number of small, inexpensive and less sophisticated computer printers is also expected to grow rapidly. Businesses are increasingly using intelligent copiers to generate forms on plain paper instead of using pre-printed forms, and Abitibi-Price and others are known to be working to produce a groundwood forms paper that will run efficiently through high-speed office printers. Manufacturers producing free-sheet forms bond say such a product would be a serious competitor in the fast-growing forms market.

A competitive groundwood forms sheet is not an easy thing to make, however (see the previous discussion of Hunt Harris's views). Indeed, in recent years the two most exciting new uncoated groundwood products in the North American market—SC and groundwood forms—are probably the most difficult to manufacture.

Nevertheless, Star Forms president Hunt Harris told the Uncoated Groundwood Conference that total groundwood use by the forms industry should rise from 330,000 short tons in 1982 to 610,000 tons in 1990. Of this, carbonless will shoot up from 130,000 tons to 245,000 tons, while standard groundwood forms stock constitutes the balance. In the standard groundwood forms area, almost all the growth occurs in stock continuous forms, which computer printers might use. Of the total, stock forms will rise from 255,000 tons to 550,000 tons. "By 1990, 90% of all groundwood papers sold to the forms industry should go to the stock continuous forms segment," he added.

During this period, Harris sees the market share of groundwood papers rising to 29% from 26%.

COATED PAPERS

GRADE STRUCTURE

Coated paper generally falls within two groups, depending on whether the paper is coated on one side (C1S) or on two sides (C2S). C1S paper, representing just under 7% of all coated paper production in 1983, is generally used for labels, while major C2S end uses include publications and commercial printing.

C2S papers range in quality downward from a super-premium grade, representing the most expensive and high-quality sheet, and a slightly lower-priced No. 1, to No. 5, at the other end of the scale in quality and price. Super-premium and Nos. 1 to 3 are made essentially from chemical pulps, while No. 4 can contain a large amount of mechanical pulp, and No. 5 always contains a high percentage of mechanical pulp. No. 5 is the most important in terms of tonnage, and each successively higher-quality grade is smaller in terms of tonnage than the one below it. According to one estimate, No. 1 represented only 3.3% of C2S production in 1983, while No. 2 was 6.5%, No. 3 was 14.5%, No. 4 was 19.6%, and No. 5 was 56.1%.

Some shift in market share has been seen among the C2S grades in the last 20 years, with coated No. 5 losing share over the years to Nos. 3 and 4. No. 5's share in 1983, at 56.1%, was well above the combined 34.1% share of Nos. 3 and 4. But in 1971 the split was 27% for Nos. 3 and 4 against 67% for No. 5. A decade earlier than that the market share split was even more dramatic.

Within these major categories, different grades are produced to fit the requirements of various printing methods, including letterpress, offset and rotogravure. Offset represents the largest portion of C2S publication papers and has been growing in importance at a fairly rapid rate. According to one estimate, offset represented only 19% of all C2S paper in 1964 but rose to 55% by 1971. The percentage jumped to 73% by 1980, a year when letterpress represented 14%—down from 35% in 1971—and gravure was 13%—up from

U.S. STATISTICS FOR COATED GROUNDWOOD PUBLICATION PAPERS

	1982	1983	1984e
Production, 000 tons[1]	2,902	3,193	3,454
Capacity, 000 tons[2]	3,242	3,452	3,598
Utilization rates, %	89.5	92.5	96.0
Imports, 000 tons	70	150	150
Exports, 000 tons	35	33	35
Apparent U.S. consumption			
000 tons	2,937	3,310	3,569
lb/capita	25.41	28.36	30.31
000 tons/$ billions real GNP (1972)	1.98	2.15	2.23

e = Estimate.
[1] PULP & PAPER estimates.
[2] API capacity for coated groundwood papers—includes coated grade No. 5 and some of No. 4.

U.S. STATISTICS FOR COATED FREE-SHEET PAPERS

	1982	1983	1984
Production, 000 tons[1]	2,090	2,210	2,340
Capacity, 000 tons[2]	2,274	2,402	2,487
Utilization rate, %	91.9	92.0	94.1
Imports, 000 tons	12	25	35
Exports, 000 tons	47	45	36
Apparent U.S. consumption			
000 tons	2,055	2,190	2,339
lb/capita	17.78	18.77	19.86
000 tons/$ billion real GNP (1972)	1.38	1.42	1.46

e = Estimate.
[1] PULP & PAPER estimates.
[2] API capacity survey.

9.5% in 1971.

Offset printing demands paper with smooth surface and good pick resistance due to the tacky inks used. Letterpress printing is relatively less demanding as far as surface properties are concerned but is governed by a basis weight minimum because of a problem with strikethrough in low basis weight papers. Gravure printing, preferred for long press runs, requires a smooth surface, along with controlled ink receptivity.

Paper coating methods also vary according to quality desired along with speed of operation. The trend in recent years has been toward on-machine coating, although off-machine coating is still common among many older commodity-grade coated paper mills and specialty grade mills. The most frequent arrangement is for one coating station to apply coating to a side, although the same station can be used to apply coating simultaneously to both sides. Paper can also receive two coats on the same side, or a precoat may be applied to smooth out surface roughness.

Coating formulations may vary but a typical coating solution consists of pigments (kaolin clay, titanium dioxide or calcium carbonate), binders, and additives to control viscosity and other rheological properties. Excess water must be dried from the coating in a fast and efficient manner since water makes up as much as 50% of a coating formulation, and common methods are through-air drying, drum drying or infrared drying.

After excess water is removed, the coated sheet is next supercalendered if a glossy finish is desired, and it may be supercalendered through the nip of many rolls to develop the gloss further. If a high-gloss finish is required, as with an enameled sheet, a gloss calender is used. Dull finish and matte finish are distinguished by the supercalendering process—or lack of it, in the case of some dull finish paper. Dull finish paper gets light pressure from the supercalender, or none at all, while matte finish paper goes through a supercalender with one stack that has been sandblasted or engraved to imprint the matte appearance. Matte finished paper gives a gloss test reading of 20 or less, while dull finish could reach 45 or 55 on the gloss scale and glossy finish would be higher.

The bulk of C2S paper is given a glossy finish, although matte finish has made some gains in market share in recent years. One estimate claims that glossy coated represented 89% of all C2S paper in 1970 but slipped marginally to 86.5% in 1976, while matte finished paper rose from 6% to 10% in that period. Dull finish remained basically unchanged at about 3% of all C2S shipments. During that time coated No. 5 remained over 90% glossy, although the percentage of

TYPICAL PROPERTIES OF COATED PUBLICATION GRADES

General characteristics	Typical use	Basestock	Coating	Brightness
No. 1 Enameled, double-coated, hand-sorted expensive base and coating; high gloss; basis weight above 70 lb	Annual reports	High-brightness chemical pulp; heavily filled	High in TiO_2; high gloss enameled; synthetics	82-88
No. 2 Double-coated, expensive base and coating	Expensive advertising	High-brightness chemical pulp; filled (clay)	High in TiO_2 some clay; synthetics	78-82
No. 3 Single- or double-coated, lower-quality basesheet	Advertising	Chemical pulp; minor amounts of groundwood	Mostly clay, some TiO_2 less expensive	76-82
No. 4 Lower cost, lower brightness	Magazine	Groundwood and chemical pulp, some clay filler	Less expensive; coating—clay and TiO_2	72-78
No. 5 Lower basis weight, high groundwood content	Directories, catalogs, magazines	Mostly groundwood or TMP, chemical pulp for runability	Variable, some contain synthetics	68-72

No. 5 made with a glossy finish fell from 95% to 93%, with matte rising to 6.5% of all No. 5 from 3.5% in 1970.

INDUSTRY STRUCTURE

Coated paper production is concentrated in a small number of hands, with 16 companies claiming virtually all of industry capacity and about half of the capacity controlled by five top companies. Within specific areas of the industry the concentration is even greater.

In No. 5, the top five companies are estimated to represent 57% of total capacity for that grade. St. Regis Corp., the largest manufacturer of that grade, installed a 168,000-tpy coated groundwood machine in Sartell, Minn., in 1982. At the same time, Weyerhaeuser Co. and Mead Corp. brought online light to medium weight coated groundwood paper machines to make coated No. 4 or 5—at Columbus, Miss., in the case of Weyerhaeuser (new 175,000-tpy machine), and at Escanaba, Mich., in the case of Mead (new 200,000-tpy machine).

In Nos. 1 to 3, four companies dominate: Champion International Corp., Mead, Scott Paper Co. and Westvaco Corp. All four have either planned or contemplated further capacity expansion in the next few years, although only Scott (200,000 tpy at Skowhegan, Maine, startup first-half 1983) has actually installed a new machine in recent years.

Westvaco, however, did say in mid-1984 that it would announce plans in the fall of the year for a new coated free-sheet machine. It also indicated it would follow with another capacity expansion of similar size in the following five years. The program, Westvaco added, will increase its coated paper capacity by about two-thirds. *Pulp & Paper* estimates this would increase Westvaco capacity by 280,000 tons from its present 420,000-ton level. Luke, Md., was considered to be a likely site for the first machine.

No other actual announcements had been made as of mid-1984, although Midtec Paper Corp. is rebuilding paper machine Nos. 1 and 5 at its Kimberly, Wis., mill to add 40,000 tpy of coated free-sheet and groundwood

CANADIAN FINE PAPER PRODUCERS[1]—ESTIMATED ANNUAL CAPACITY

(000 short tons)

	Coated & uncoated	Coated
Domtar	440	70
Rolland Inc.	156	—
Kruger Inc.	154	154
Great Lakes Forest Prod.	135	—
Abitibi-Price Inc.	125	125
Island Paper Mills[2]	110	—
Fraser Inc.[3]	104	20
Eddy Paper Co.	104	—

1. Does not include uncoated groundwood paper grades.
2. Owned 50% by Macmillan Bloedel and 50% by Fraser.
3. Does not include half-ownership in IPM.

NEW NORTH AMERICAN COATED PAPER CAPACITY THROUGH 1987

Company	Location	Annual short tons	Startup
Repap Enterprises	Newcastle, N.B.	190,000	First half 1986
Kruger[1]	Trois Rivières, Que.	77,000	First half 1986
Bowater	Catawba, S.C.	200,000	Second half 1986
Consolidated Papers	Wisconsin Rapids, Wis.	175,000	1987
Under study or rumored			
Nitec Paper[2]	Niagara Falls, N.Y.	80,000	First half 1985
International Paper	Pine Bluff, Ark.; Jay, Me.; Mobile, Ala.	300,000	1985-86
St. Regis/Champion	Sartell, Minn.	175,000	n.a.
Weyerhaeuser	Columbus, Miss.	175,000	n.a.
Blandin Paper[3]	Grand Rapids, Minn.	175-200,000	n.a.

n.a. = Not available.
1. New coater to use paper from existing paper machines.
2. Restart of idle mill possible in first quarter of 1985.
3. In December 1984 British Columbia Forest Products (parent of Blandin) announced study of possible machine was dropped for time being.

Source: PULP & PAPER WEEK, PULP & PAPER PROJECT REPORT.

capacity. Modernization of No. 7 machine was also believed to be under study.

Coated paper shipments in Canada are not broken out by Canadian Pulp & Paper Assn., but by one estimate total coated paper output was 203,000 metric tons in 1982, an increase of about 6.8% from the previous year. Virtually all of that increase was caused by rising shipments to the U.S. since domestic coated paper shipments are believed to have fallen about 2.4% in 1982. Most of the 37,000 short tons in coated paper shipped by Canada to the U.S. in 1982 was coated groundwood from Kruger Inc. Domestic coated groundwood shipments are estimated to have represented 66.4% of domestic coated paper shipments in 1982, down from 67.4% the previous year. Free-sheet C2S was about 20% of domestic coated production in 1982, unchanged from the previous year.

Strong coated paper demand in the U.S. pushed U.S. imports of Canadian coated up to about 58,000 short tons in 1983, nearly all of it coated groundwood.

TRENDS IN LWC PUBLICATION GRADES

The most important market for lightweight coated paper (under 40-lb basis weight) is magazines, and magazine demand trends dictate LWC supply trends. Mailing cost of the average U.S. magazine rose from about 1.8c in 1970 to 8c or more in 1980 and 1981, and the crunch on delivery costs forced publishers to begin seeking ways to cut expenses. Paper basis weight became a prime candidate.

The same factors affect the booming direct mail catalog business. William Fitzgerald, Hanover House Industries senior executive vice president, told *Pulp & Paper*'s First Uncoated Groundwood Papers Conference in New York, N.Y. (November 1983) that development of lighter-weight catalog papers is of the utmost importance.

CAPACITIES OF MAJOR U.S. COMPANIES, 1984

	Annual capacity (000 tons)	Capacity share (%)
1. St. Regis	625	17.4
2. International Paper	450	12.5
3. Consolidated Papers	380	10.6
4. Boise Cascade	306	8.5
5. Mead	300	8.3
6. Crown Zellerbach	285	7.9
7. Blandin Paper	257	7.1
8. Midtec Paper	200	5.6
9. Pentair Industries	180	5.0
10. Weyerhaeuser	175	4.9
11. Great Northern Nekoosa	165	4.6
12. Fraser Paper Ltd.	160	4.4
13. Bowater (Bowater Carolina)	124	3.4

U.S. capacity (1984): 3.598 million tons.
Capacity share of top five companies: 57.3%.
Capacity share of top ten companies: 87.8%.

U.S. COATED PAPER PRODUCTION

(000 short tons)

	API	PULP & PAPER estimates[2]			
	(Total coated)[1]	(Total coated one-side)	(Total coated two-sides)	(Total C2S Nos. 1-4)	(Total C2S No. 5)
1983	5,743	390	5,290	2,320	2,965
1982	5,032	365	4,610	2,025	2,580
1981	4,951	395	4,485	2,035	2,450
1980	4,673	375	4,240	1,840	2,400
1979	4,642	410	4,230	2,080	2,150
1978	4,593	440	4,155	2,000	2,155
1977	4,274	415	3,860	1,640	2,220
1976	3,890	410	3,480	1,490	1,990
1975	3,076	330	2,740	1,120	1,620
1974	3,739	410	3,330	1,650	1,680
1973	3,757	435	3,320	1,430	1,890
1972	3,455	400	3,055	1,040	2,015
1971	3,165	360	2,805	905	1,900

1. Shipments for both one- and two-side coated papers.
2. May not add up due to rounding.

"The U.S. Post Office, I believe, will enact a major postal rate change in two to three years. At present the cost of third class mail is determined by a pound rate. This means the minimum change for the various third class rates is based on 3.91 oz., with an increased charge for mail over that weight. The proposal will be to charge a standard per piece, per pound rate, just like first class," Fitzgerald said. And that will drive catalog producers' costs way up if lower-weight paper is not used.

In the early 1970s, LWC for high-volume magazines such as *Time* and *Business Week* was considered to be 40-lb paper. One estimate places paper below 36 lb at about 10% of all coated No. 5 shipments in 1970, rising to 20% in 1976. Paper between 36 lb and 40 lb fell from 32% in 1970 to 13% six years later. Those trends have continued since then, with 34-lb paper now the major lightweight grade and papers as light as 32 lb and 30 lb appearing in the market as well.

While publishers that formerly printed on 40-lb paper have moved toward 34-lb stock, publishers that previously opted for 50-lb paper have shifted down toward 45 lb or 40 lb. On the other hand, specialty magazines that could be targeted toward particular audiences—thus increasing the cost-effectiveness of advertising while appealing, often, to wealthier audiences—are increasing their share of the magazine market. And they are often printed on higher-quality,

U.S. PRICES FOR COATED PUBLICATION PAPER

($ per short ton)

	No. 1 70-lb sheets	No.3 60-lb rolls	No. 5 34-lb rolls (roto)
1984			
3rd quarter	1,310	930	890
2nd quarter	1,310	930	830
1st quarter	1,310	870	830
Year-end			
1983	1,250	830	782
1982	1,200	798	760
1981	1,130	798	760
1980	1,038	750	735
1979	970	690	671
1978	893	621	573/590
1977	*	600	520/545
1976		540	460
1975		486	399
1974		475	400
1973		*	285

* Earlier data not available.

Source: PULP & PAPER PRICEBOOK.

MAJOR COATED U.S. FREE-SHEET PRODUCERS

(1984 capacities—000 tons)

	Annual capacity (000 tons)	Capacity share (%)
1. Scott Paper[1]	525	21.1
2. Westvaco	420	16.9
3. Champion International	357	14.4
4. Mead	300	12.1
5. Consolidated Papers	190	7.6
6. Potlatch[2]	150	6.0
7. Simpson Paper	123	4.9
8. Midtec Paper	100	4.0
9. Boise Cascade	54	2.2
10. Watervliet Paper	42	1.7
11. P. H. Glatfelter	40	1.6
12. Plainwell Paper	40	1.6
13. James River	35	1.4

U.S. capacity (1984): 2.487 million tons.
Capacity share of top five companies: 72.1%.
Capacity share of top ten companies: 90.9%.

[1] S.D. Warren Div.
[2] Northwest Div.

U.S. COATED PAPER CAPACITY

(000 short tons)

	Coated free sheet	% change	Coated ground-wood*	% change
1987	3,069	3.7	4,262	10.3
1986	2,959	3.9	3,863	3.2
1985	2,849	5.4	3,744	1.2
1984	2,704	9.3	3,701	5.1
1983	2,473	8.9	3,522	6.3
1982	2,271	1.2	3,312	8.7
1981	2,225	0.2	3,047	10.3
1980	2,222	0.4	2,762	10.1
1979	2,214	5.6	2,511	2.5
1978	2,096	5.4	2,450	1.7
1977	1,989	4.5	2,408	12.2
1976	1,903	−1.5	2,299	8.1
1975	1,938	—	2,127	−4.8
1974		total coated grades	4,075	0.7
1973			4,045	4.6
1972			3,866	0.2
1971			3,778	0.2
1970			3,700	−0.1
1969			3,732	—

* Includes all coated paper capacity until 1975.

Source: American Paper Institute.

heavier-weight paper, often No. 3 coated.

Not all the arguments are in favor of reducing basis weight. Since publishers print paper on an area basis but buy it on a weight basis, they pay a premium for lightweight paper. Also, press runability falls as basis weight declines, resulting in greater paper losses.

The magazines that have gone farthest in reducing basis weights have been those with mass circulations where postage savings are greatest. Such magazines are often intended for a market that will pay less per copy and absorb newsstand or subscription price increases less readily than specialty magazines. Popularity of LCW, thus, will at least partly depend on the ability of the mass-market magazines to compete with television and newspapers for advertising. Another recent trend whose impact on paper use can not yet be quantified is the increased experimentation on the part of some mass-market magazines with private distribution systems in urban areas.

Meanwhile, with coated groundwood in short supply in 1984, consumers were forced in some instances to look for other grades of paper, including heavier-weight coated papers and especially uncoated, for some incremental uses. K-Mart, the retailer, experimented with printing an insert in Fed. Rep. Germany on German 38-lb coated stock. Some other inserts were printed on supercalendered uncoated groundwood or roto news. The great majority of customers, however, continued to insist on the print quality of coated—even to the extent where some allegedly paid $1,000/ton—a 25% premium over domestic lists—for 40-lb coated groundwood from Italy.

Technological efforts in LWC mills have centered around maintaining surface properties and runability while cutting weight. Publishers place greater value on runability and printing characteristics (such as ink holdout and ink gloss) than on opacity, and the mechanical integrity of the sheet—i.e., no flaws—becomes more important.

Once basis weights fall below about 36 lb, it becomes important to reduce weight of both the basestock and the coating. Some mills make the reductions primarily in coat weight—going to a 6-lb coating, for example, from a 10-lb or more—while others reduce the weight of the basestock by a greater percentage. Some mills can use a lighter-weight basesheet than others. Surface smoothness is the deciding factor.

Mills add kraft fiber to lend tearing strength, as well as to avoid breaks, carry flaws and maintain paper machine and press runability. But a large proportion of the sheet comes from groundwood fiber, which offers reduced cost while maintaining opacity and surface smoothness.

Stone groundwood has higher opacity than thermomechanical pulp, but mills such as Weyerhaeuser's new Columbus, Miss., coated groundwood mill have chosen to use TMP pulp because of its greater strength, which allows for reduced chemical pulp content and may help out with the shorter-fiber southern pulp in the case of southern mills. Because of its ability to cut chemical pulp usage, TMP should find its way into more coated groundwood sheets in the future as capacity is added.

Titanium dioxide is favored in LWC coating, with specialized clay, such as delaminated grades, providing the balance of the coating's content. Below 32 lb, synthetic organic pigments are used. With densities about half that of clay—allowing for a 3-lb coat weight, for example, instead of a 6-lb coating—these pigments allow for retention of much of the basis weight of the basesheet. Most mills making LWC have at least run successful trials using synthetics, but sheets below 32 lb are still rare, and thus synthetics have not yet gained the prominence of clay.

MARKETS FOR COATED PAPERS

Magazines represent the largest market for coated paper, using 43% of all C2S paper production in 1983. At various times in the past decade that percentage has ranged as high as 52%—in terms of 1983 C2S output levels, a swing of more than 475,000 tpy. According to one estimate, of the 2.45 million tons of paper used by

COATED PAPER SHIPMENTS TO MAGAZINE PUBLISHERS (1978-83)

(000 short tons)

Grade	1978	1980	1982	1983
Coated two-sides	1,902	1,838	2,010	2,290
Nos. 1-4	365	400	425	470
No. 5	1,537	1,438	1,585	1,820
All grades	2,054	2,017	2,130	2,450
Coated paper imports	214	189	69	162

Source: American Paper Institute and Champion International Corp.; PULP & PAPER estimates.

PAPER SHIPMENTS TO COMMERCIAL PRINTERS

(000 short tons)

Grade	1980	1981	1983
Coated two sides paper	1,650	1,750	2,075
C2S Nos. 1-4	1,200	1,300	1,535
C2S No. 5	405	420	540
Uncoated free sheet	2,000	1,950	2,165
Uncoated groundwood	220	175	245
Total	3,800	3,900	4,515

Source: PULP & PAPER estimates.

magazines in 1983, 2.29 million tons were coated, with 4% of paper shipments to magazines coming from Nos. 1 to 3, 16% coming from No. 4, and 74% from No. 5. The balance represents C1S and uncoated paper.

A trend can be seen toward lighter basis weights in publication-grade paper. Total shipments of No. 5 in recent years have risen at close to 9%/year, but the under 36-lb class has grown at 13%/year and better. With No. 5 up 14.5% in 1983, the growth in the lightweight end was even more rapid than usual.

Another major market, where coated paper demand has been rising strongly, is catalogs, taking almost 500,000 tons of coated paper in 1981—17% more than the previous year. Nos. 4 and 5 are the fastest growing segments of the coated catalog paper market, and No. 5, with about 435,000 tons in 1983, was the biggest segment—with a healthy 18% growth rate to its credit.

Only about 250,000 tpy of coated paper was going into the book market in the mid-1980s, but in 1983 that grew at 8%, while shipments of all papers to book publishers were up only 4%, indicating an increased publisher preference for the better graphic qualities of coated paper.

The other major market was commercial printing, with 2.1 million tons of coated paper going into that market in 1983. Of the coated paper segment of commercial printing, the market share split by grade was as follows: No. 1, about 8%; No. 2, 15%; No. 3, 27%; No. 4, 23%; No. 5, 26%, C1S 2%. Commercial printing takes up about 37% of all coated paper production.

Some efforts have been made in recent years during soft markets to increase the coated groundwood market share of the commercial printing market through coating variations to improve the brightness from a typical coated groundwood range of about 70 to 72 (GE) to a range more conducive to sales in the commercial printing segment—somewhere between the 74 of a brand introduced in the early 1980s by St. Regis and the 78 of a product introduced by International Paper Co. Some companies that marketed high-brightness coated groundwoods on a regular or experimental basis included IP, Crown Zellerbach Corp., St. Regis, Fraser Inc. and Midtec/Nitec Paper Corp.

C1S paper totals around 400,000 tpy, of which about 82% goes into labels, representing 92% of all label paper.

OUTLOOK FOR COATED PAPERS

Coated paper demand is expected to continue for the balance of the decade at or near recent growth rates, which have averaged somewhat over the Gross National Product. Publishers and printers alike have shown a preference for the superior printing qualities of coated paper—as opposed to either uncoated free sheet or uncoated groundwood—in an increasing number of instances.

Indeed, that trend has so far continued despite recessions and coated paper price increases. In fact, coated paper demand has been so strong in recent years that some believe a change in advertisers' preferences has occurred.

During the recession of the early 1980s, more than 500,000 tpy of new coated groundwood capacity came online in 1982 alone, temporarily overloading the system. During that period, however, shipments continued to rise at a healthy rate despite the recession, and the market quickly absorbed the new capacity—three to four years faster than anyone had expected.

The new capacity did produce a brief period of lower prices that lasted through the first nine months of 1983. In the fall of 1983, however, coated paper prices started heading back up and, through the summer of 1984, had jumped by 10% to 18%, depending on the grade.

In approximately the same period the three new coated groundwood machines started up, Scott brought online a new 200,000-tpy coated free-sheet machine aimed at the No. 3 web market. And in 1981, the market had faced the startup of a 160,000-tpy supercalendered uncoated groundwood machine at Madison Paper Industries' Madison, Maine, mill and a similar-sized coated groundwood unit at Boise Cascade Corp.'s Rumford, Maine, facility. By mid-1984 all of those installations were running full-out, and their operators were turning away business.

U.S. COATED PAPER EXPORT/ IMPORT BALANCE

	Exports[1] (000 short tons)	Imports[2]
1984e	100	270
1983	79	162
1982	81	69
1981	89	39
1980	92	115
1979	74	189
1978	74	214
1977	99	113[3]
1976	107	—
1975	123	—
1974	99	—
1973	80	—
1972	76	—
1971	76	—
1970	75	—
1969	70	—

e = PULP & PAPER estimate.

[1] Clay-coated printing and writing paper.

[2] Coated and impregnated printing papers.

[3] In previous years, coated paper imports were reported under another category.

Source: Bureau of the Census.

This heroic performance on the part of the publication paper market is a testament, more than anything else, to the health of the print media as an advertising vehicle. New, specialized magazines and new, often upscale direct mail catalogs—both developments a consequence of more sophisticated mail promotion and targeting techniques—absorbed much of the growth in paper demand. The well-to-do audience desired by publishers of these catalogs and magazines seemed to justify the extra expenditure in high-quality coated paper.

How long this boom can continue is impossible to tell, but it seems clear that shopping at home is now a way of life for many Americans to an extent not known since the old days when the Sears, Roebuck & Co. catalog brought an element of comfort to western families. That being the case, most analysts feel coated paper has probably reached a new level, with a substantial decline in consumption not likely before the hypothetical future day when electronic media replace paper.

Not too long ago it was felt that one threat to coated paper came not from green electron tubes but from white rolls of SC paper, offered for sale at $100/ton less than LWC. It was argued that in a recession, with business concerned about saving money, a less costly paper that could be used to achieve adequate results would attract many advertisers. Also, it was felt, in a tighter market some advertisers would shift to SC because of lack of availability of LWC.

The latter has happened, but it hasn't hurt any LWC manufacturers because there has been more than enough demand to go around. And regarding the former possibility, one executive pointed out in 1984 that if a large enough group of buyers of LWC to be painful were to decide to use SC instead of coated, there would not be nearly enough SC capacity in the world to satisfy them all, even with Madison's new No. 3 machine (and the restarted No. 1, which makes a supercalendered rotonews).

Additionally, it is not yet clear whether SC has gained enough acceptance to justify the kind of capacity investment that would make this grade a credible threat to coated mills. Instead, what SC remains is an acceptable alternative for some customers who want to save money by downgrading, an acceptable alternative for some customers who want to win extra business by upgrading from rotonews, and an acceptable alternative for some customers who can't get as much LWC as they'd like in a tight market. The existing suppliers of SC to North America may have a secure and happy future, but as yet they constitute no visible threat to the coated paper industry.

RISE OF ROLLSTOCK vs SHEET-FED PAPER IN U.S. COATED PAPER INDUSTRY

(% of total coated paper shipments)

	Rolls	Sheets
1980	85%	15%
1975	80	20
1970	80	20
1965	77	23

Source: PULP & PAPER estimates.

It is possible to construct a scenario in which such a threat would develop, however. At one point in early 1984, it was thought that as many as ten or a dozen different companies may have been considering installation of supercalenders after existing machines or to serve new machines devoted to making some grade of SC paper. In the majority of cases, these expenditures were related to upgrades of old newsprint machines to make a more value-added product.

If enough companies were to learn how to make a quality SC news or SC magazine paper—no easy challenge, SC manufacturers claim—readily available for printers, SC would then be something more than a novelty for customers. When the catalog, magazine, and cents-off coupon markets finally level off, the cost advantages of an uncoated paper might lead a number of consumers to abandon their prejudice in favor of coating. A danger to SC could arise, however, if the market is flooded with poorly-made paper that scares customers away from trying the grade in the future.

One executive suggests that if coated paper demand remains robust through the 1980s while the high cost of financing restrains capacity additions, profit-happy coated paper producers might price themselves out of a lot of business by raising lists and thus opening up such a price differential between their product and uncoated paper that SC or some other grade of uncoated would look quite attractive.

Or mills might just raise prices so far and so fast that the print media simply lose their cost-effectiveness for advertisers in the face of some new, developing technology such as cable television or videotex.

Despite the threat that expensive capital may prevent further capacity expansion, LWC producers in mid-1984 were contemplating new machines at as many as five different mills, while Westvaco was planning a major coated free-sheet expansion, and at least two more companies had similar expansions under study for the end of the decade.

To many companies, the cost of installing coated paper capacity may look like a bargain compared with their expenses in other areas of the paper industry. Fred Iannazzi, president of Andover International Associates, told an AIA/*Pulp & Paper*/*Pulp & Paper International* conference titled "North America in the '80s," in May 1984 that the ratio of sales to investment for new facilities ranges from $0.33 of sales per dollar of investment in the case of virgin fiber-based newsprint and an awful $0.27 in the case of corrugating medium up to a high of $0.74 in the case of coated groundwood.

UNCOATED FREE-SHEET

GRADE STRUCTURE

Uncoated printing and writing papers find their way into a variety of end-uses ranging from personal stationery to carbonless basestock for business forms, and the one uniting characteristic is that they are all uncoated papers made largely from chemical pulps (sulfate, sulfite, soda, cotton linter or vegetable fiber). Most contain no mechanical pulp at all, although paper with up to 10% mechanical pulp can still be classified as uncoated free-sheet and therefore be included within this category.

Four major subgroupings can be discerned within the uncoated printing/writing paper family, based on end-use: publishing, commercial printing, office and writing paper. A fifth and smaller subgrouping includes minor products such as cigaret papers and carbonizing tissue (discussed under the heading Thin Papers).

Most important end-uses for the U.S. market in terms of tonnage are offset printing paper, representing about 26% of all shipments in 1983; bond/mimeo/duplicating/xerographic, representing 24%; forms bond, 21%; envelope, 11%; and tablet, 5%. A typical classification of uncoated free-sheet papers by end-use follows:

U.S. STATISTICS FOR UNCOATED PRINTING/WRITING PAPERS

	1984e	1983	1982
Production*, 000 tons[1]	9,300	8,767	7,847
Capacity, 000 tons	10,028	9,522	9,039
Utilization rate, %	92.7	92.1	86.8
Imports, 000 tons	475	236	169
Exports, 000 tons	70	59	71
Apparent U.S. consumption			
000 tons	9,705	8,944	7,945
lb/capita	82.42	76.6	68.7
000 tons/$ billion real GNP (1972)	6.07	5.82	5.35

e = Estimate.
* American Paper Institute data for shipments.
1. All tons are short tons.

Source: PULP & PAPER.

UNCOATED FREE-SHEET PAPERS CLASSIFIED BY END-USE

Printing/publication	Business
Offset (book)[1]	Forms bond[1]
Lightweight printing[1]	Copy & reprographic[1]
Envelope[1]	Carbonless[1]
Tablet[1]	Mimeograph[1]
Cover & text[1]	Duplicating[1]
	Other
Writing	**Thin papers**
Bond	Carbonizing
Cotton fiber[2]	Cigaret
	Condenser
Bristols[2]	

1. Conforms to American Paper Institute classification of free sheet.
2. This grade discussed in separate section.

OUTLOOK

Good times were back again with a vengeance for uncoated free-sheet mills in 1983, particularly in the second half of the year. American Paper Institute figures showed shipments shooting up 11.6% for all of 1983. This is a dramatic contrast to the 0.4% drop in 1982 and a decline of 1.5% in 1981.

The two-year period of stagnation in the early 1980s followed growth in the 1970s that had averaged 4.2%/yr. Clearly, 1983 represented a return to historic patterns of consumption, and figures through mid-1984 showed that, while recovery was maturing, growth was not exactly withering: shipments in the first six months of 1984 were 6.9% ahead of the year-earlier period.

That year-over-year performance was not expected to continue through the second half, however, given the robust act the industry had to follow after the second half of 1983. And, indeed, API figures showed new orders off by 2.4% from the year-earlier pace in June 1984 and unfilled orders down by 20.3%. Nevertheless, shipments in 1984 could approach or exceed 9 million tons, outstripping 1980—the best-ever year prior to the recent recession—by 1 million tons.

A healthy order book for the industry as a whole doesn't necessarily translate into high operating rates for individual companies, however. While one executive estimates the industry ran at 95% for the first six months of the year, a series of machine startups beginning with Union Camp Corp.'s Eastover, S.C., mill in the fall of 1984 seemed likely to give the market a temporary case of indigestion. The Union Camp startup was on top of a 150,000-tpy unit started up by Champion International in Courtland, Ala., in 1983 and Crown Zellerbach's new 160,000-tpy Camas, Wash., machine, which came online in the firt half of 1984.

Between 1983 and 1987 or 1988, the U.S. industry plans to add almost 1.5 million tons of capacity, in

U.S. PRODUCTION AND CAPACITY OF UNCOATED FREE-SHEET PAPERS*

(000 short tons)

	Production[1]	% change	Capacity[2]	% change
1987	—	—	11,266	3.2%
1986	—	—	10,915	3.4
1985	—	—	10,554	4.7
1984e	9,240	5.4	10,083	7.8
1983	8,767	10.5	9,354	4.7
1982	7,933	1.5	8,937	1.2
1981	7,814	−2.4	8,828	2.1
1980	8,008	4.6	8,645	6.8
1979	7,655	4.6	8,095	3.1
1978	7,315	3.9	7,847	5.1
1977	7,036	9.4	7,465	2.0
1976	6,430	22.6	7,319	1.9
1975	5,243	−18.8	7,180	1.9
1974	6,457	0.1	7,046	7.7
1973	6,450	9.5	6,541	5.5
1972	5,886	10.0	6,198	7.2
1971	5,349	3.3	5,780	1.3
1970	5,177	−0.8	5,702	0.3
1969	5,222	—	5,681	—
Average 1971-84		4.2		3.9

e = PULP & PAPER estimate.

* Excluding cotton fiber, bristol, and thin paper.

1. Source: Bureau of the Census.

2. Source: American Paper Institute.

RISE OF ROLLSTOCK VS SHEET-FED PAPER IN U.S. UNCOATED FREE-SHEET PAPER INDUSTRY

(% of total uncoated free-sheet shipments)

Year	Rolls	Sheets
1983	65%	35%
1980	61	39
1975	53	47
1970	45	55
1965	35	65

Source: PULP & PAPER estimates.

ESTIMATED 1984 ANNUAL CAPACITIES FOR MAJOR COMPANIES FOR UNCOATED PRINTING/WRITING GRADES

(000 short tons)

	U.S.	Canada	Total
1. Champion International	922	—	922
2. International Paper Co.	800	—	800
3. Boise Cascade Corp.	791	—	791
4. Great Northern Nekoosa	725	—	725
5. Hammermill Paper Co.	647	—	647
6. Union Camp Corp.	500	—	500
7. Weyerhaeuser Co.	450	—	450
8. P.H. Glatfelter Co.	430	—	430
9. Mead Corp.	398	—	398
10. Domtar Inc.	—	370	370
11. James River Corp.	357	—	357
12. Simpson Paper Co.	355	—	355
13. Scott Paper Co.	300	—	300
14. Fraser Inc.	150	135*	285
15. Georgia-Pacific Corp.	268	—	268
16. Crown Zellerbach Corp.	230	—	230
17. Westvaco Corp.	210	—	210
18. Finch, Pruyn & Co.	200	—	200
19. Pentair Inc.	187	—	187
20. Eddy Paper Co. Ltd.	60	104	164
21. Willamette Industries Inc.	160	—	160
22. Rolland Paper Co.	—	156	156
23. Wausau Paper Mills co.	154	—	154
24. Great Lakes Forest Products	—	135	135
25. Technographics Inc.	130	—	130
26. Penntech Papers Inc.	120	—	120
27. Mosinee Paper Corp.	112	—	112
28. Potlatch Corp.	77	—	77
29. Newton Falls Paper Mill	75	—	75
30. Howard Paper Mills	73	—	73
Other companies	1,202	55	1,257
Total	**10,083**	**955**	**11,038**

*Includes 50% interest in Island Paper Mills' 110,000-tpy facility in New Westminster, B.C. Other 50% owned by MacMillan Bloedel Ltd.

addition to nearly 500,000 tons being installed in Canada in the 1983-89 period (see table). With most commodity grades of uncoated free sheet already in plentiful supply in mid-1984, the next few years could see a fairly sloppy market if demand doesn't pick up considerably and if a few old machines aren't shut down or upgraded to specialty products.

For the long haul, most observers expect forms bond and copy paper to continue benefiting from current information processing and office printing trends. And by one estimate, forms bond shipments were up 13% for the first five months of 1984. But the short run is a different matter, and copy and bond papers were not performing according to script—edging up a sparse 2.7% through May. And both forms bond and cut-size paper, along with offset printing papers, were subject to occasional discounting during much of 1984.

At least part of the problem was the weakness of some overseas markets. Commerce Dept. figures through May 1984 showed uncoated free-sheet imports running at an annual rate of 550,000 tons, compared with a final tally of 236,000 tons in 1983. Uncoated book paper imports were up 107.5% through May, while writing papers jumped a dramatic 469.4%. Much of this trend was caused by the strength of the U.S. dollar relative to foreign currencies, but some of it was also caused by the need to generate dollars on the part of cash-strapped Mexico and Brazil. Both situations seemed unlikely to end soon.

Perhaps the largest single cause of the softness going into 1984 was inventory-building on the part of the ultimate customer. Oversupply in the marketplace killed a price increase floated in July 1984. As the U.S. economic recovery matured and economic growth rates slowed down—and as new papermaking capacity came online—it seemed certain that pricing would be weak and operating rates problematic for the short-term future. The outlook for 1985 and beyond depends on a continuation of the economic recovery, although there was no sign yet of an imminent return to the disastrous demand and pricing conditions of 1982.

FIBER COSTS FOR PRODUCING PRINTING GRADES AT NONINTEGRATED PAPER MILLS

Year	45 lb No. 3 offset sheets ($/short ton	Hardwood kraft market pulp ($/short ton)	Ratio of selling prices (pulp/paper)
1984	900	459	0.510
1983	840	377	0.449
1982	680	338	0.497
1981	878	440	0.501
1980	785	440	0.560
1979	714	380	0.532
1978	645	295	0.457
1977	552	250	0.452
1976	506	300	0.592
1975	484	335	0.692
1974	535	335	0.626
1973	457	225	0.492
1972	460	135	0.293
1971	455	135	0.296
1970	442	150	0.339

Note: All prices are year-end, except 1984 which is 2nd quarter.

Source: PULP & PAPER PRICEBOOK.

INDUSTRY STRUCTURE

U.S. uncoated free-sheet mills are located principally in the Northeast and Midwest but the last 20 years have seen an increasing number of machines added or announced for the South, with Alabama and the Carolinas two of the major centers.

Indeed, since 1975, and including projects announced through 1986, the only major expansions announced outside the South have been a new International Paper machine in Maine in 1977, a 1979 Georgia-Pacific conversion from newsprint, a new Boise Cascade machine in Washington in 1980, a Mead machine starting up in 1982 in Ohio, and a Crown Zellerbach machine in Washington in 1984. At the same time there have been substantial capacity reductions in the Northeast.

Recent years have also seen a shift in the industry toward larger machines, with machines over 125,000 tpy rising from 7.5% of industry capacity in 1975 to 19.3% in 1982, while machines of 75,000 tpy and below fell from 72.5% of industry capacity in 1975 to 62.6% in 1982.

At the same time there has been a trend toward reduced reliance on purchased pulp, with the percentage of industry capacity represented by integrated mills—mills with active on-site pulpmaking capacity—rising from 64.8% in 1976 to 80.3% in 1982, according to American Paper Institute figures.

Mills in the Northeast and Midwest tend to be smaller in capacity, older, nonintegrated, and equipped with paper machines of 150-in.-trim or less. Many of these mills, of necessity, produce specialty grades that larger mills could not make economically, and also emphasize smaller runs in order to serve the needs of a wide variety of merchants, printers and other customers.

While this builds customer loyalty, it does little to insulate the mill from some of the other penalties of nonintegration, including the volatility of market pulp prices in times of tight pulp supply. A small number of these mills have experimented with buying deinked pulp or pulp substitutes (white shavings, etc.).

The cost penalty these mills encounter—along with the advantages they enjoy in times of pulp oversupply such as in early 1982—is shown in an accompanying table. In 1970 the cost of pulp represented only 33.9% of selling price, whereas in 1980 it had risen to 56.0%. But then in early 1982, with hardwood pulp available at sharp discounts and the list price for pulp unchanged from 18 months earlier, pulp represented only 50.1% of the paper grade's selling price assuming no pulp discount, and a still lower percentage if discounts could be secured. The pulp cost advantage of an integrated mill, $100 in 1980, had probably declined as the pulp market slid.

With the price of pulp recovering in mid-1984, however, and uncoated free sheet plagued by continued discounting, the cost of pulp had climbed back up to 56.1% of the paper grade's selling price.

Nonintegrated mills tend to have higher fuel costs since they can't benefit from wastewood to supply biomass boilers or from byproduct fuel from kraft liquor. However, being closer to major markets in the North, they may have lower transportation costs.

The trend in new capacity has been toward large fourdriniers or twin-wire machines located in southern mills and producing commodity-type grades such as offset paper, forms bond and reprographic paper. These mills use a blend of hardwood and softwood pulps, with hardwood fibers providing desired bulk and printing characteristics and softwood fibers offering strength properties for improved paper machine and printing press runability.

OFFSET PAPERS

Offset papers are generally considered to fall within the family of book papers, a term that can include tablet and envelope paper as well as offset. The common strand running through all these grades is that they are all made to be used for printing and graphic arts purposes, or can be readily produced on the same machines as printing papers. Distinguishing characteristics include surface finish, opacity, brightness and bulk.

Not all offset paper is shipped to book publishers—slightly more than 2.1 million tons of uncoated offset paper was produced in 1983, while total uncoated free-sheet shipments to book publishers did not reach 450,000 tons. At the same time, not all paper used to print books is uncoated free-sheet—in 1983, uncoated free-sheet represented just 57% of the 760,000 tons of paper shipped to book publishers, while uncoated groundwood represented 10%, and the coated grades represented another 33%.

Consumption of paper for books tends to track Gross National Product except for recession years, although the book industry has stagnated in the 1980s. Overall consumption of book papers slipped by 0.2% in 1981—a

NEW U.S. AND CANADIAN UNCOATED FREE-SHEET CAPACITY THROUGH 1985

Company, U.S.	Location	Capacity (short tons)	Year
Champion International	Courtland, Ala.	150,000	1983
Crown Zellerbach	Camas, Wash.	160,000	1984
Georgia-Pacific[1]	Crossett, Ark.	100,000	1984
Westvaco[1]	Wickliffe, Ky.	35,000	1984
Union Camp	Eastover, S.C.	215,000	1984
International Paper[1]	Mobile, Ala.	120,000	1984
Georgia-Pacific	Crossett, Ark.	50,000	1985
Georgia-Pacific	Port Hudson, La.	230,000	1986
Weyerhaeuser[2]	Columbus, Miss.	200,000	n.a.
Hammermill[2]*	Selma, Ala.	n.a.	n.a.
Company, Canada		**(metric tons)**	
Island Paper Mills	New Westminster, B.C.	77,000	1983
Great Lakes Paper[1]	Dryden, Ont.	135,000	1984
Domtar[3]	Windsor, Que.	176,000	1986
Domtar	Windsor, Que.	176,000	1989

North American capacities, 1984
U.S.: 9.554 million short tpy
Canada: 1.232 million short tpy

n.a. = Not available or not applicable.
1. Machine conversion or modernization.
2. Machine announced or discussed in principle but plans not finalized.
3. During 1986-9 period, Domtar will also be shutting down 97,000 tpy of old machines.

Source: PULP & PAPER WEEK estimate, American Paper Institute, Canadian Pulp & Paper Assn.

year when the GNP rose by about 1.5%. This continues a trend begun the year before when shipments fell by about 10%, following an inventory-building 1979. But then in 1983, consumption of book paper was 4% ahead of 1982, not too far off the 6% growth rate of the GNP. Uncoated free-sheet has been losing market share to coated paper, however, due to customer perceptions of superior printing qualities in coated stock.

Offset and other uncoated free-sheet paper has also lost market share to coated for commercial printing purposes. Uncoated free-sheet shipments to commercial printers edged down by 0.6% in 1981 to less than 1.95 million tons, representing 50.0% of all commercial printing papers, while coated jumped by 7.1% to 1.8 million, or about 45.5% of commercial printing shipments. By 1983, uncoated free-sheet was down to 48% of the 4.5 million tons of paper shipped to commercial printers, while coated represented 47% of the market.

Offset papers can be sold in rolls or in sheets (cut or folio sizes), and in 1983 rolls represented about 65% of all offset paper shipments.

Commercial printing press needs dictate that roll diameter and width be standardized, and for stock roll grades typical diameters are 32-in. and 40-in. Standard widths are 11-, 17-, 22- and 35-in. If nonstocked sizes are ordered, a trim penalty is typically assessed against the purchaser.

Offset and other uncoated book papers are made to run on high-speed offset presses, with the sheet surface sized externally at a size press on the paper machine to prepare the surface for the slight wetness inherent in offset printing. A high degree of resistance to picking is also essential.

Titanium dioxide and other fillers are used to give specific levels of opacity, and a range of qualities and prices is guaranteed by the wide variation in furnish, filler and brightness that is available. Opacified offset paper also has a slightly higher brightness and 2% to 3% higher opacity rating than standard offset book paper. Each mill typically makes a number of grades to meet specific printing quality and price requirements, so specifications for offset grades can vary. Properties typical for a No. 1-type offset sheet are listed in the accompanying table.

Mills can offer a lower-priced offset paper by introducing recycled fiber or mechanical pulp to the furnish, thereby retaining relatively high opacity levels but offering a lower brightness rating. Other variations among uncoated book papers are in bulk and sheet surfaces, with bulk being influenced by changes in basis weight as well as surface treatment. Some common sheet surfaces include antique, eggshell, woven and English.

LIGHTWEIGHT PRINTING GRADES

Lightweight printing grades represent the bottom end of the printing paper market in terms of basis weight, generally falling under the 40-lb (25x38 in., 500 sheets) range, and being used for products ranging from Bibles to business forms. One estimate from 1980 places the percentage of forms bond manufactured in the 25- to 38-lb (LWP weights) basis-weight range at 61%.

Opacity should be at about 85% for LWP grades over 26-lb basis weight, and such papers are heavily loaded with fillers to accomplish this goal. Lighter still are the bible papers, ranging from 19-lb to 24-lb, with opacities of 80% to 85%. LWP papers are favored for some uses in which it is important to reduce the page weight and bulk of books or catalogs.

LWP papers are made from a variety of fibers, including chemical pulps, cotton fiber, flax straw or a combination of these fibers. Production data for these grades are not available.

TYPICAL GRADE STRUCTURE FOR 100% FREE-SHEET OFFSET PAPERS

Basis weight (lb, 25x38 in., 500 sheets)	Grammage (g/m^2)	Opacity[1] (%)
35	52	82
40	59	86
45	62	87
50	74	89
55	81	91
60	89	90
70	104	92
80	118	94

[1] Government specifications for offset book printing paper; however, these are similar to those used by most companies for high-quality offset with brightness of 80-85.

BASIS WEIGHT AND BULK OF LWP PAPERS

Basis weight (lb, 25x38 in., 500 sheets)	Typical bulk (sheet/in.)
19* (28 g/m^2)	1,360
20* (30 g/m^2)	1,290
22* (33 g/m^2)	1,180
24* (36 g/m^2)	1,080
26 (38 g/m^2)	900/940
28 (41 g/m^2)	870/900
30 (44 g/m^2	810/850
33 (49 g/m^2)	740/790
35 (52 g/m^2)	690/700
40 (59 g/m^2)	610/640

* Bible grades.

COVER AND TEXT PAPERS

On the other end of the basis-weight scale are cover and text papers, heavier in weight than offset papers and intended for use as the cover of magazines, pamphlets or paperback books, as well as text pages of such publications. Some cover and text papers can even be as heavyweight as bristols, and they are sold in coated as well as uncoated grades. Cover stock can be embossed, coated, plastic-coated or laminated with cloth.

Quality and price are higher than for offset paper. Cover and text papers are made in a variety of colors and finishes, and they are made by the same companies

PRODUCERS OF LWP AND THIN PAPERS

Lightweight printing

Allied Paper Inc.
Jackson, Ala.

P.H. Glatfelter Co.
Neenah, Wis.

James River Co.
Kalamazoo, Mich.

Fletcher Paper Co.
Alpena, Mich.

Fraser Paper Ltd.
Madawaska, Me.

Kimberly-Clark Corp.
Lee, Mass[1]
Neenah, Wis.

Olin Corp.
Pisgah Forest, N.C.

Port Huron Paper Co.
Port Huron, Mich.

Sorg Paper Co.
Middletown, Ohio

Champion International[2]
Deferiet, N.Y.

Cigaret

Kimberly-Clark Corp.
Spotswood, N.J.[1]
Ancram, N.Y.[1]

Olin Corp.
Pisgah Forest, N.C.

1. Schweitzer Div.
2. Formerly St. Regis Paper Co.

COVER AND TEXT PAPERS: TYPICAL GRADE STRUCTURE

Text		Cover	
Basis weight (25x38, 500)	Grammage (g/m²)	Basis weight 20x26, 500)	Grammage (g/m²)
60	53	50	135
65	96	60	162
70*	103	65*	176
75	111	80*	216
80*	118	90	243
100	140	100	270

* Major weights.

U.S. PRODUCTION OF UNCOATED COVER AND TEXT PAPERS

(000 short tons)

Year	Cover	% change	Text	% change
1983	85	13.3	160	18.5
1982	75	—	135	−6.9
1981	75	−1.3	145	−10.5
1980	76	−5.0	162	−0.5
1979	80	8.1	163	18.1
1978	74	8.8	138	13.1
1977	68	19.3	122	2.5
1976	57	32.6	119	5.3
1975	43	−17.3	113	−29.8
1974	52	−5.5	161	−2.4
1973	55	12.2	165	13.0
1972	49	14.0	146	5.8
1971	43	—	138	—

Source: PULP & PAPER estimates.

TYPICAL BULKS FOR BOOK PAPERS AT DIFFERENT BASIS WEIGHTS AND SHEET FINISHES

		Standard bulks		
Basis weight (25x38, 500)	Antique (ppi)*	Eggshell (ppi)	Standard (ppi)	Eng. finish (ppi)
45	—	492	540	600
50	410	440	488	540
55	360	386	444	500
60	330	364	408	440
70	288	316	350	390

* ppi = Pages (sheets) per inch.

Source: International Paper Co.

that manufacture offset and bond papers. Bleached board producers such as Federal Paper Board and Temple-Eastex also make cover stock, especially coated cover stock.

Demand for these grades has grown by about 3.1%/year for the last decade, although the weak book market of 1981 slowed the growth of this 220,000-tpy market to 1.7% in that year. The healthy commercial printing recovery in 1983 pulled total shipments of cover and text stock up to the 240,000-ton level, however, a 14% improvement over 1982. Text represented 66% of the market and grew at a 16% rate in 1983, while cover jumped by 12%. Demand for coated cover and text papers should continue to outpace uncoated due to preference for the higher printing characteristics of coated paper.

BOND, MIMEOGRAPH, DUPLICATING AND COPY (MBDX) PAPERS

The BMDX grades are a natural family, so similar in sheet properties and basis weights that many mills make the same paper for more than one end-use, and mills commonly swing among grades depending on strength of demand for particular products. They are internally and surface-sized since they are also commonly used for offset printing.

PAPER SHIPMENTS TO U.S. BOOK PUBLISHERS, 1980-81

(000 short tons)

Grade	1983	1980
Coated two-sides	250	240
C2S Nos. 1-4	190	150
C2S No. 5	60	90
Uncoated free sheet	435	475
Uncoated groundwood	75	115
Total	**760**	**825**

Source: PULP & PAPER estimates.

These papers are generally made from 100% chemical pulp, with opacity in the mid- to high-80s and brightness in the low-to-mid-80s. High-quality bond papers are often made with some cotton fiber; they are discussed in a separate chapter.

Bond papers. The importance of the bond and writing paper market has grown tremendously in the last 20 years. Annual shipments rose from 372,000 tons in 1960 to 1.8 million in 1983, and the market had jumped by 14% in 1983 from the previous year's recession-depressed level. Inventory accumulation began in earnest in late 1983, however, and reached excessive levels in the first half of 1984, hurting price stability.

A major new user of cut-size bond and copy papers and forms bond is the computer printer, which can produce not only forms-oriented data processing but also reports and other cut-size-paper-type printouts. Modern non-impact electrophotographic laser printers such as the Siemens ND-2 are capable of speeds up to 200 pages per minute (PPM), and the installed base of such machines—made largely by Siemens, IBM and Xerox—is expected by Siemens to grow from 5,000 in 1982 to more than 16,000 in 1987. And, important for the North American industry, two-thirds of those installations are expected to be in North America. Siemens also projects that total worldwide volume of computer printing will rise 9%/year, with 1.5 trillion pages in 1985.

Manufacturers of nonimpact printers claim a variety of paper grades other than cut-size bond can be used, including fan-fold or rolled forms bond, recycled paper, preprinted forms, coated paper, labels and even plastics.

Bond papers are made in a wide variety of qualities and prices to meet the full range of office and stationery uses, with a typical No. 4 bond (20- to 24-lb) listing for $870/ton in the first and second quarters of 1984—virtually unchanged from the level of two years earlier, in the early stages of intense discounting in the recent recession. In the first half of 1982, however,

COMMON BASIS WEIGHTS FOR BMDX GRADES

Basis weight (17x22, 500)	Grammage (g/m²)	Bond	Mimeograph	Duplicating	Copy
13	49	X			
16	60	X	X	X	
18	68	X	X	X	
20	75	X	X	X	X
24	90	X*	X		X
28	105	X*			
32	120	X*			
36	135	X*			

* Ledger grades.

paper was actually selling for $130 to $190/ton less than that list price, whereas in early 1984 transaction prices were only slightly below list.

Copy papers. Plain-paper copiers are the dominant type and have reduced coated-paper copiers to a toehold in libraries, schools, drugstores and other low-volume copy sites. Xerox is the best known of the roughly two dozen companies offering plain-paper copiers, and demand for paper for this type of machine is likely to grow dramatically in future years as a result of color copying capabilities, high-speed copiers, intelligent copiers and other developments. Most copiers use cut-size, 8½x11- or 8½x14-in. paper, but a few, such as the IBM Copier II and the Xerox 1860, are roll-fed. High-speed copiers can achieve rates of 120 PPM or more, while inexpensive copiers may produce as few as 6 PPM. Liquid or dry toners are used.

Plain-paper copy papers are made on the same machines that produce bond and offset papers, have similar characteristics and are produced from chemical pulps. Uniformity of caliper is particularly important for fast copiers, as are stiffness, cleanliness, stacking uniformity and the ability to lie flat.

Uncoated free sheet represented 99.0% of the 1.4 million tons of printing/writing paper shipped for office reprographic purposes in 1981, but the 14,000 tons of coated paper made for copy purposes was consumed by coated-paper copiers that represented 50% of the number of copy machines installed in that year, by one estimate. Coated-paper copiers tend to be small, slow and low-cost. Papers for such copiers include dielectric and zinc-oxide-coated papers.

Demand for copy paper slipped during the recent recession, but a combination of the roaring economic recovery and an accumulation of inventories pushed up shipments of copy paper by 18% in 1983, by one estimate. More sustainable growth rates of about 5% are seen for the forseeable future.

Dielectric paper for nonimpact printers and facsimile transmission will probably show strong demand increases, but other coated paper copy demand should be largely stagnant in coming years.

Copy papers as a whole will benefit from the development of the electronic office—a phenomenon which should be understood here to include not just video display terminals and electronic data transmission services, but also a plethora of intelligent copiers that can create forms, print on both sides of paper in a single operation, sort, collate and staple—virtually replacing in-plant printing operations. These systems in many cases, however, are not just replacing in-plant printing one-for-one, with no increase in paper consumption—

U.S. PRICES FOR UNCOATED WHITE PAPER

($ per short ton)

	Bookpaper No. 3 offset +45-lb sheets	Bond, No. 4 unwatermarked 20-24-lb sheets	No. 1 watermarked +20-lb sheets	Forms bond 15-lb rolls	Bond 25% cotton sheets
1984					
3rd quarter	900	870	985	795	1,730
2nd quarter	900	870	985	795	1,730
1st quarter	900	870	985	795	1,730
Year-end					
1983	840	810	960	745	1,650/1,730
1982	680	640	916	640	1,650
1981	878	867	916	753	1,650
1980	813	803	848	697	1,490
1979	711/717	720	778	620	1,309/1,343
1978	645	640/644	695	538/550	1,190/1,230
1977	548/555	548/590	645/650	450/500	1,143
1976	506	561	628	519/520	1,083
1975	484	550	605	495/504	1,012
1974	535	559	637	470	984
1973	457	495	n.a.	n.a.	734
1972	460	470	n.a.	n.a.	728
1971	455	460	n.a.	n.a.	719
1970	442	445	n.a.	n.a.	n.a.

n.a. = Not available.

Source: PULP & PAPER PRICEBOOK.

they are allowing for a dramatic increase in the number of reports, brochures and other documents that can be cheaply and quickly printed by many offices, permitting a significant increase in sales by paper suppliers.

FORMS BOND

Forms bond papers are made to be printed on high-speed, continuous data-processing equipment that employs direct-impact printing methods. The paper itself has qualities similar to those of offset printing papers, and paper mills with the capability to make both grades sometimes switch back and forth in times of market weakness in one grade or the other—as in the poor offset market of 1981-82 when many mills increased their shipments of forms bond.

Physical requirements for the sheet include good stiffness and strength for fast feeding and printing and for refolding without distortion, a good printing surface which is free of lint, good dimensional stability for perfect register and a high degree of paper cleanliness.

Unlike some uncoated free-sheet papers, forms bond competes directly with lower-priced papers having high groundwood content. Top-quality forms bond is 100% chemical pulp fiber, with a blend of softwood and hardwood kraft pulps common. But some producers add a degree of secondary (recycled) fibers as a cost- and price-cutting measure, or some groundwood pulp to accomplish the same end. Many blended (free-sheet/groundwood) forms sheets are priced as much as 25% below free-sheet bond in a normal market, while the primarily-groundwood forms papers are priced at around 50% below free-sheet prices.

Leader producers of free-sheet forms bond include Boise Cascade Corp., International Paper Co., Mead Corp., and Georgia-Pacific Corp., while G-P has been a pioneer in blended bonds and Abitibi-Price Inc. and Great Northern Nekoosa Corp. are leaders in groundwood forms paper. The groundwood product is often not surface-sized, sacrificing printing press runability and printability, and has lower brightness and opacity than the free-sheet product, but has a considerable price advantage.

FORMS BOND: TYPICAL GRADE STRUCTURE

Basis weight (17x22, 500)	Grammage (g/m²)
9	34
10	38
12	45
15	53
16	56
18	68
20	75
24*	90
28*	105
32*	120

* Ledger/tag weights.

Typical groundwood forms uses are for internal record-keeping where appearance is not important. Blended bonds, on the other hand, are often surface-sized and may have a good appearance as well, offering an attractive middle road between the two extremes. In times of free-sheet discounting, however, the blended product seems to get squeezed out.

Abitibi-Price and others making groundwood forms paper are said to be working hard to improve the quality of the sheet so that it can be run successfully through high-speed printers, and a marketing executive with a company making blended bonds said he considers such a product to be among his biggest single competitive worries since it would remove an important advantage of blended bonds.

Uncoated free-sheet bond represented 90% of all shipments to business forms converters in 1983, while uncoated groundwood, at 240,000 tons, made up only 10%. The groundwood segment was growing much faster—16% in 1981 alone, in contrast with a 5.4% increase for uncoated free-sheet bond in that year—and at one time was widely expected to eventually capture perhaps as much as 20% of the market. But the discounting of 1982 brought transaction prices for free-sheet bond down to groundwood levels and led some users to switch back to their traditional favorite; that reversal of earlier trends has continued during the market recovery. Whether groundwood will soon get back on track remains to be seen.

Carbonless paper forms are also used for multi-part continuous forms. Basestock for carbonless coating represents a market of nearly 400,000 tpy, and grew by 5% in 1983.

Another development affecting the forms bond industry in recent years, in addition to competition from groundwood forms paper, has been a slow but steady rise in basis weights, due in part to the increased preference for heavyweight single-part forms as opposed to lightweight multi-part forms. One executive cited a study that showed the average basis weight of U.S. forms bond production rose from 15.1-lb in 1972 to 16.1-lb in 1980, with the 10- to 14-lb range falling from 34.3% of all forms bond in 1972 to 21.1% in 1980. In that time the 16- to 25-lb paper rose from a 21.9% market share to 39.7%.

A further major factor for forms bond has been the jump in the number of small personal and business computers installed in recent years. Such computers, along with word processors, use both stock continuous forms and cut-size paper, and their projected popularity will guarantee a healthy growth rate for forms bond in coming years. Most observers expect an overall forms bond growth rate in coming years of 4% to 5%, after a post-recession surge of 12% in 1983. Forms bond capacity has been relatively flat in recent years, with only one new machine coming online in the early 1980s: Willamette Industries' 100,000-tpy Hawesville, Ky., unit, onstream in late 1981. Several new machines that came online in 1984 are used to make forms bond as well as other uncoated grades, and increasing customer acceptance of groundwood forms would find several Canadian newsprint manufacturers ready and eager to switch over old newsprint machines to make such a product. The possibility of price weakness for the next couple of years in commodity free-sheet could soon begin to induce mills to postpone investment decisions, however.

CARBONLESS PAPER

Carbonless paper has increasingly replaced carbon paper in uses for which an image must be transferred by impact or pressure to a second piece of paper. Common end-uses are business forms, order books, receipts and so on. The image is transferred from the top or "donor" sheet to succeeding sheets with the aid of an encapsulated dye coated onto the back side of the paper. When the top surface is imprinted, the pressure breaks the dye on the back and the image is transferred to the top of the next sheet. The receiving side is coated with kaolin clay to enhance the sharpness of the received image. Up to five replicas can be made.

The basestock (CB) for a carbonless form is produced from high-quality chemical pulps on a standard fourdrinier paper machine, with the receiving sheet being coated on the paper machine and the stock then going to an off-machine coater for the encapsulated dye. When more than two sheets are desired for a set of forms, the intermediate sheets (CFB) are coated on the front with kaolin and on the back with dye. The last sheet (CF) is coated on the front but not on the back, with a top coating to receive the image.

Production figures for carbonless forms are not published and are nearly impossible to come by, but one executive with a company making the product estimates total U.S. production at about 390,000 tons in 1983, while one-time carbonizing paper production in the U.S. in 1983 was just over 150,000 tons.

Appleton Papers Inc. is the leader in carbonless forms basestock, with Mead Corp. also a force in the market. Appleton is also a major converter, and as such converts the basestock into forms by applying the dye on off-machine coaters and then rolling the paper into sets. Other major converters include 3M Co. and Nashua Corp. Recently Mead offered a process, called OPAS, to produce carbonless forms at printing plants by modifying existing offset presses, thus allowing printers to expand their use of carbonless paper.

THIN PAPERS

Thin papers bear a resemblance to tissue paper and are used to produce a variety of products, such as carbonizing tissue, cigaret and condenser papers and other papers for specialized uses (lens cleaning and stencils are two such minor uses).

Carbonizing is the major product, with carbon black or pigments being coated onto a bleached or unbleached basesheet by a converter and then combined with a bond sheet to form one-time carbon paper. One-time carbon forms are used in over half of all multi-part forms, despite inroads from carbonless forms, but the market shift toward continuous forms—and especially continuous forms produced on office computers and intelligent copiers capable of generating a form and filling it in, using a blank roll of forms paper—has eroded the share of the forms market represented by multi-part forms. Star Forms Inc.'s president Hunt Harris told *Pulp & Paper*'s First Uncoated Groundwood Papers Conference (November 1983) that

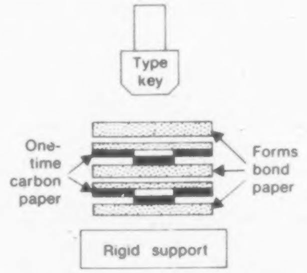
CARBONIZING BASE STOCK AND CARBONIZING TISSUE PRODUCTION

(000 short tons)

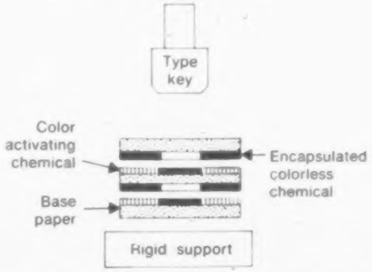
	1983	1982	1981	1980
Carbonizing	150	180	180	181
Carbonless	390	370	320	295

Source: PULP & PAPER estimates.

ONE-TIME CARBON AND FORMS BOND PAPER



CARBONLESS PAPER FORM



"paper tons going to one-part forms will increase from 29% to 62% of the total market" between 1972 and 1990.

Basis weights range widely but a typical weight (20x30 in., 500 sheets) would be 8.65 lb. The sheet is made on a yankee fourdrinier paper machine at medium speeds of around 2,000 fpm, with chemical furnish being used, and refined to form a tight sheet devoid of pinholes.

Other important thin papers include cigaret paper, a strong, highly filled lightweight product made largely from flax straw. The paper is heavily filled with precipitated calcium carbonate to give a controlled burning rate. Principal producers in the U.S. are Olin Corp.'s Ecusta Paper Div. and Kimberly-Clark Corp.'s Schweitzer Div.

Electrical paper includes a number of grades such as insulating, condenser, capacitor and dielectric, with condenser and capacitor papers falling under the thin paper classification. Reliable estimates of production are not available, but *Pulp & Paper* believes they total considerably less than 20,000 tpy among them. Some electrical papers, such as insulating paper, are listed under "special industrial papers" and their tonnages are not included in estimates here. They are discussed elsewhere in this book.

CARBONIZING TISSUE PRODUCERS

1. Burrows Paper Corp.
   Little Falls, N.Y.
2. Consolidated-Bathurst Inc.
   Trois Rivières, Que.
3. Domtar Inc.
   Fine Papers Div.
   St. Catharines, Ont.[1]
4. Dunn Paper Co.
   Port Huron, Mich.
   Wiggins, Mass.
5. Fletcher Paper Co.
   Alpena, Mich.
6. Fraser Paper Ltd.
   Madawaska, Me.[2]
7. International Paper Co.
   Jay, Me.
8. James River-Otis Inc.
   Jay, Me.[2]
9. Port Huron Papers
   Port Huron, Mich.
10. Seaman Paper Co. of Mass. Inc.
    Otter River, Mass.
11. Thilmany Pulp & Paper Co.
    (Div. of Hammermill)
    Kaukauna, Wis.

[1] Makes basestock for converting at another facility.
[2] Carbonizing bond only.

COTTON-FIBER PAPER

Containing between 25% and 100% cotton fiber, cotton-fiber papers are used as premium-quality bond papers, technical papers and for other special uses which require permanence and durability—such as paper currency, financial certificates and postage stamps.

The "rag content" in the pulp used to make these papers generally comes from (1) new cotton cuttings from the textile and garment industry (and formerly old rags), and (2) from linters.

Cotton linters are the short fibers adhering to cotton seed after the ginning operation and consist of the stumps or bases of the longer staple textile fibers and short fuzz fibers. The cotton cuttings from new cotton fabrics are generally classified according to textile source—unbleached muslin, white shirt cuttings, light prints, blue denims, etc.

Cotton, in the form of either the staple fiber used in the textile industry or of cotton linters, is the purest natural form of cellulose (98% to 99% alpha content) and this gives cotton-content paper its durability. The cotton fibers used in cotton-content papers are usually blended with sulfate or sulfite woodpulps. The blended pulp is highly refined or beaten to develop a sheet with crackle and good strength. It is sized internally (beater sizing) to produce a proper level of holdout to inks. When a cockle finish is desired, the sheet is air-dried.

Competition for cotton fibers from clothing and other industries has reduced availability of 100% cotton scraps, and made 100%-cotton bond scarce and expensive. Sulfite bond has been used as a substitute because of its purity and permanence compared with sulfate papers.

Cotton-content papers are sometimes watermarked to leave an impression on the sheet. However, demand for watermarked sheets has been diminishing in recent years, because of the high production costs involved. Watermarking is done by means of a dandy roll on which a raised impression has been made. The dandy roll presses on the wet web as it is carried along on the fourdrinier wire. The fibers in the area of the raised impression are separated, making that area of the sheet thinner in the design of the watermark.

The old watermarking method involved soldering wires to the surface of the dandy roll in the pattern desired. This was extremely costly, and has been generally replaced with an embossing process by which the pattern is stamped into the dandy wire before it is wrapped around the roll.

Cotton-content papers are generally sold in a range of basis weights: 9, 13, 16, 20 and 24 lb (17 x 22 in., 500 sheets). They are also labeled according to sheet finishes such as light cockle, cockle, smooth, vellum, and linen. In addition, they are categorized according to their colors and sheet properties (which include whiteness, opaqueness, onionskin).

Production of cotton-content papers has been relatively static in recent years. U.S. production in 1978 was 119,000 tons. It rose to 130,000 tons in 1979 and 131,000 tons in 1980, but then fell to 113,000 tons in 1981 and 108,000 tons in 1982, according to the Dept. of Commerce.

American Paper Institute statistics are somewhat higher, though. According to API, production of cotton-fiber papers reached 120,000 tons in 1982 and rose to 131,000 in 1983. Industry executives say the market continued to improve in 1984, with production up 12.2% during the first half of the year compared with a year earlier, while the overall printing and writing sector was up about 10% over the same period.

COTTON-CONTENT PAPERS: GRADE DISTRIBUTION

(short tons)

	1982	1981	1980
Total writing, cotton fiber	108,094	112,987	130,823
Bond and writing	89,699	89,856	92,876

Source: Bureau of the Census.

Pricing also was strong in 1982 for cotton-content papers. A 6.5% price hike that went into effect in November 1981 for U.S. customers and in December 1982 for Canadian buyers was one of the few price increases in the printing/writing industry which held in that period. By year-end the price for 25% cotton in sheets had risen to an average of $1,650/short ton compared with $1,549 a year earlier. Again in 1983, prices rose to $1,730, where they remained for the first half of 1984.

Pricing for cotton-fiber papers has been aggressive in recent years, although this was partly necessary to offset rapidly rising costs for cotton cuttings and linters. Since 1974, the price of 25%-cotton-content bond paper has risen more than 75%. The price escalation has probably caused some users to switch to other grades of printing and writing papers, but, overall, sales have remained strong.

Only about 20 companies, with small mills mainly in the Northeast and upper Midwest, produce any significant tonnage of cotton-fiber papers. Because most of these mills can also produce bond-type grades from 100%-chemical-pulp furnish, production is controlled mainly by demand rather than capacity.

Capacity for these grades has remained relatively flat for the past 15 years, according to API figures. Since 1969, when it reached 159,000 tons, capacity has risen and fallen slightly, reaching just 162,000 tons in 1983. By 1987, API forecasts, capacity will rise to 181,000 tons.

NORTH AMERICAN PRODUCERS OF COTTON-CONTENT PAPERS

Company/mill	Capacity[1] (tons/day)
1. Sorg Paper Co., Middletown, Ohio	300
2. Eastern Fine Paper, Brewer, Me.[2]	180
3. Kimberly-Clark Corp., Neenah, Wis.[3]	162
4. Beckett Paper Co., Hamilton, Ohio[4]	160
5. Crane & Co. Inc., Dalton, Mass.	140
6. Howard Paper Mills Inc., Dayton, Ohio	140
7. Gilbert Paper Co., Menasha, Wis.[5]	95
8. Strathmore Paper Co., Turners Falls, Westfield, and Woronoco, Mass., mills	90
9. Fletcher Paper Co., Alpena, Mich.	82
10. Monadnock Paper Mills, Bennington, N.H.	75
11. Byron Weston Co., Dalton, Mass.[6]	60
12. James River-Fitchburg Inc., Fitchburg, Mass.	60
13. Rising Paper Co., Housatonic, Mass.	50
14. Domtar Inc., Fine Paper Div., Beauharnois, Que.	40
15. Millers Falls Paper Co., Millers Falls, Mass.[7]	40
16. Parsons Paper Co., Holyoke, Mass.[8]	32
17. Curtis Paper Co., Neward, Del.[9]	24
18. Harding-Jones Paper, Middletown, Ohio	22
19. Southworth Co., W. Springfield, Mass.	20
20. Esleeck Mfg. Co., Turners Falls, Mass.	18

1. Total mill capacity (short tons), including fine paper.
2. Affiliate of Eddy Paper Co. Ltd.
3. Includes Whiting mill in Stevens Point, Wis.
4. Div. of Hammermill.
5. Div. of Mead Corp.
6. Sub. of Crane & Co. Inc.
7. Sub. of Strathmore.
8. Div. of NVF Co.
9. Div. of James River Paper Co.

PRICING TRENDS FOR BOND PAPERS

($/short ton)

Year-end	Forms bond[1]	25% cotton[2]
1984[3]	795	1,730
1983	745	1,650/1,730
1982	(640)	1,650
1981	*753	1,549
1980	697	1,490
1979	620	1,343
1978	544	1,210
1977	475	1,143
1976	520	1,083
1975	500	1,012
1974	470	984
1973	—	728
1972	—	719

1. Average price for rolls.
2. Average price for sheets.
3. As of June 1984.

* Discounting from list prices reported.

( ) Indicates estimated transaction prices where volume is moving significantly below lists.

BRISTOLS

GRADE STRUCTURE

Bristols are bleached or semibleached kraft paper, slightly lighter than bleached boards but heavier than true printing and writing grades, usually with a thickness or caliper of 0.006-in. or more.

Included in the bristol grades are tabulating index, tag and file folder, index bristols, printing bristols, postcard, and coated bristols, as well as mill or "bogus" bristols, which are bristol-type recycled paperboards made on cylinder paper machines.

Tabulating stock is used primarily for computer tab cards and must have superior dimensional stability and electrical characteristics. It is produced on fourdrinier paper machines from semibleached kraft pulps.

Printing bristols are used in a variety of ways, and can be either coated on one side or uncoated. Many have characteristics similar to cover grades. Lower-caliper (below 0.015 in.) coated bristols are produced on fourdrinier paper machines from a blend of bleached hardwood and softwood kraft pulps. Hardwood improves the printing surface and adds bulk.

Mill bristols extend the availability of printing bristols to calipers of 15 points and higher. They are produced by a number of companies making specialty paperboard.

Index bristols have a fairly good printing surface which is extremely erasable. Both tag and index bristols are normally produced on fourdrinier paper machines. Although both grades are similar, tag bristol is stronger and more durable.

OUTLOOK

Demand for bristols has declined overall since the late 1970s at a compounded annual rate of 0.75% (1976-83). In 1983-85, however, the market is expected to grow by 2.5%/yr, according to Morgan Stanley & Co. estimates.

Although projected growth is not dramatic, there are some bright spots in the market, particularly in the

BLEACHED BRISTOL PRODUCTION BY GRADES

(000 short tons)

	1983e	1982	1981	% change (1970-83)
Total	900	834	1,077	−16.4
Tabulating	133	123	500	−74.6
Tag	196	181	186	5.1
Folder	124	117	72	72.2
Index Printing Postcard	215	200	141	52.0
Coated	232	213	179	29.6

e = PULP & PAPER estimate. Source: Bureau of the Census.

U.S. STATISTICS FOR BRISTOLS

	1984e	1983	1982	1981
Production[1], 000 tons*	970	900e	834	904
Capacity[2], 000 tons	1,058	1,049	1,069	1,035
Utilization rate,%	91.7	85.8	78.0	87.3
Imports, tons	660	471	391	910
Exports, 000 tons	7.0	5.0e	4.4	6.4
Apparent U.S. consumption				
000 tons	1,623	1,366	2,440	1,808
lb/capita	6.9	11.7	10.5	15.6
000 tons/$ billion real GNP (1972)	1.00	0.89	1.64	1.20

e = PULP & PAPER estimate. * All tons are short tons.

[1] Bleached bristols, Bureau of the Census data.

[2] Bleached bristols, American Paper Institute data.

areas of direct-mail advertising and commercial printing.

Production of printing bristols in 1984 was increasing at a rate of about 7% during the first half compared to the same period a year earlier, market observers said. In 1983, production was up more than 11% from the previous year, which was also a good year for the industry. This growth is expected to take up some of the slack in demand for other bristol grades.

Total 1982 production of uncoated bristols—including printing, index and postcard stock—was down to 200,088 tons from 209,036 tons a year earlier, according to Dept. of Commerce figures. Tabulating index has suffered the most since the bristol market began to deteriorate in the 1970s. From 1970 through 1983, tabulating index, or tabcard, stock output fell more than 73% due to the drop in computer systems which require tab cards. Demand for this grade is expected to continue to decline as newer computers are introduced which rely on tape or disc input.

Orders for bristol grades used in offices, such as folders and index stock, are expected to drop slowly in

PRODUCERS OF BRISTOL GRADES

Mill bristol*

Beveridge Paper Co.
Indianapolis, Ind.

Boise Cascade Corp.
Sheldon Springs, Vt.
Beaver Falls, N.Y.

Byron Weston Co.
Dalton, Mass.

Evers Paper Co.
Utica, N.Y.

Lowe Paper Co.
Ridgefield, N.J.

Sonoco Products Co.
Holyoke, Mass.

Index/printing

Boise Cascade Corp.
Brownville, N.Y.
Beaver Falls, N.Y.

Champion International
Hamilton Ohio,

Domtar Inc.
St. Catharines, Ont.
Toronto, Ont.

E.B. Eddy Forest Products Ltd.
Beauharnois, Que.
Brewer, Maine
Hull, Que.

Fox River Paper Co.
Appleton, Wis.

Gilbert Paper Co.
Menasha, Wis.

International Paper Co.
Bastrop, La.
Moss Point, Miss.

James River-Fitchburg
Fitchburg, Mass.

Kimberly-Clark Corp.
Neenah, Wis.

Mohawk Paper Mills Inc.
Cohoes, N.Y.
Waterford, N.Y.

Plainwell Paper Co.
Plainwell, Mich.

Riegel Div.
Warren Glen, N.J.

Rising Paper Co.
Housatonic, Mass.

Tag

Boise Cascade Corp.
Brownville, N.Y.
Beaver Falls, N.Y.

Domtar Inc.
St. Catherines, Ont.
Toronto, Ont.

International Paper
Bastrop, La.
Georgetown, S.C.

James River-Fitchburg Inc.
Fitchburg, Mass.

Island Paper Mills Inc.
New Westminster, B.C.

Merrimac Paper Co.
Lawrence, Mass.

Potlatch Corp.
Lewiston, Idaho

Riegel Div.
Warren Glen, N.J.
Milford, N.J

Rolland Inc.
Mont Rolland, Que.

Simpson Paper Co.
Miquon, Pa.

Sorg Paper Co.
Middletown, Ohio.

Temple-Eastex Inc.
Evadale, Texas

Union Camp Corp.
Franklin, Va.

Postcard

Diamond International
Hyde Park, Mass.

Domtar Inc.
Cornwall, Ont.

Eastern Fine Paper Inc.
Brewer, Maine.

Hennepin Paper Co.
Little Falls, Minn.

International Paper Co.
Mobile, Ala.
Ticonderoga, N.Y.

Lowe Paper Co.
Ridgefield, N.J.

Pejepscot Paper
Brunswick, Maine.

Riegel Div.
Hughesville, N.J.

Sorg Paper Co.
Middletown, Ohio

Wausau Paper Mills Co.
Brokaw, Wis.

Continued on next page

PRODUCERS OF BRISTOL GRADES, continued

Mill bristol*	Index/printing	Tag	Postcard
	Rolland Inc. St. Jerome, Que.		
	Scott Paper Co. Mobile, Ala.		
	Simpson Paper Co. Vicksburg, Mich. Miquon, Pa.		
	Sorg Paper Co. Middletown, Ohio		
	Strathmore Paper Co. Westfield, Mass.		
	Temple-Eastex Inc. Evadale, Texas		
	Union Camp Corp. Franklin, Va.		
	Wausau Paper Mills Co. Brokaw, Wis.		
	Whiting Paper Co. Menasha, Wis.		

* Includes bogus bristols and heavyweight bristols from bleached kraft used for posters, etc.

the future as computerized file systems replace traditional record-keeping methods. Production of folder stock, which has increased nearly 74% since 1970, was expected to decline to 124.00 tons in 1984 from 117,000 tons a year earlier.

The Dept. of Commerce, however, expected a rise in demand for office supplies in 1984 to boost consumption by 4% of such products as "filing accessories and data processing cards." It attributes the drop in the market in 1981-82 to the recession, which had its greatest effect on areas in which offices are most concentrated, including the Northeast, North Central and South. In addition, the top eight companies account for an estimated 55% of the industry, the government reports.

Despite modest growth projections for the overall bristols market—production was expected to rise just 2% to 3% during 1984-85, according to Morgan Stanley—limited capacity should keep operating rates at least in the low 90s through 1985.

Capacity increases have been gradual and slight in recent years, following declines in the 1970s that kept the market tight. In 1979, when capacity fell to a low of just over a million tons, the operating rate reached a high of 104%. In 1985, capacity is expected to reach 1.082 million tons and operating rates should be about

PRODUCTION TRENDS FOR BLEACHED BRISTOL

(000 short tons)

			Grades	
	Total	Tabulating index	Other uncoated	Coated
1982	834	421	200	213
1981	904	462	209	231
1980	960	476	250	234
1978	1,127	593	229	272
1977	1,034	572	209	252
1976	1,012	599	203	209
1975	936	594	169	173
1974	1,185	712	254	218
1973	1,209	796	190	223
1972	1,062	768	156	138
1971	976	735	135	106
1970	997	771	137	88

Source: Bureau of the Census.

92%, according to forecasters. API estimates capacity will rise to 1,126 million tons by 1987, the last year for which figures are available.

Bristol capacity is somewhat hard to pinpoint, however, because of the confusing delineation between bristols and other grades, including uncoated free sheet, bleached board, cover/text, and boxboard. Most industry executives suspect that bristol capacity is somewhat higher than officially reported.

Bristol pricing has been aggressive historically and holds up relatively well in comparison with some other paperboard grades which are more vulnerable in an economic slowdown. During the 1981-82 recession, bristol grade pricing was substantially stronger than for other sectors of the industry which suffered from heavy discounting. In fact, some bristol price increases went through in early 1982 at a time when almost no other printing/writing grades were going up in price. BLS figures indicate that file folder stock prices have not slipped in recent years, but have posted gains since the early 1970s of as much as 23.2%.

When the economy began to recover late in 1983, uncoated bristols rebounded sharply, posting a $50/ton price hike effective Jan. 1, 1984. Weakening in the overall printing and writing papers market later in the year, however, caused some price weakening, but the market was expected to bounce back again once the market's "correction phase" (due to a too-sudden economic recovery) was over. Observers expected demand to pick up again sometime in the second or third quarter of 1985.

CAPACITY TRENDS FOR BLEACHED BRISTOLS

	Annual capacity (000 short tons)
1986	1,066
1985	1,065
1984	1,058
1983	1,049
1982	1,062
1981	1,060
1980	1,024
1979	1,020
1978	1,194
1976	1,165
1974	1,235
1972	1,155
1970	1,112
1969	1,047

Source: American Paper Institute.

BRISTOLS: TYPICAL GRADE STRUCTURE

Grade	Uses, basis weight ranges		
INDEX: (uncoated)	Sales lists, manuals, record folders, file cards		
		Basis:	25½x30½ in., 500
		Weights:	80 lb (145 g/m^2)
			90 lb (163 g/m^2)
			110 lb (199 g/m^2)
			140 lb (253 g/m^2)
			170 lb (307 g/m^2)
			220 lb (398 g/m^2)
TAG: (uncoated)	Tags, ruled forms, timecards, menus, folders, catalog inserts, display cards		
		Basis:	24x36 in., 500
		Weights:	90 lb (146 g/m^2)
			100 lb (163 g/m^2)
			125 lb (203 g/m^2)
			150 lb (244 g/m^2)
			175 lb (285 g/m^2)
			200 lb (325 g/m^2)
POSTCARD[1]: (uncoated)	Return mailers, bills/statements		
		Basis:	22½x28½ in., 500
		Weights:	57 lb (125 g/m^2)
			67 lb (147 g/m^2)
			80 lb (176 g/m^2)
MILL BRISTOLS[2] (uncoated or coated 1-S)	Promotional folders, posters, point-of-purchase displays, tent cards, covers, etc.		
		Caliper:	0.080 in.
			0.010 in.
			0.012 in.
			0.015 in.
			0.018 in.
			0.020 in.
			0.024 in.

1. Approximate calipers: 0.009 in. for 67 lb, 0.0075 in. for 57 lb.

2. A wide range of grades, including bogus bristols. The higher-caliper grades, above 15 pt, could be produced on cylinder machines. Also available in higher calipers.

PACKAGING AND INDUSTRIAL CONVERTING

GRADE STRUCTURE

Packaging and industrial papers include a wide range of unbleached and bleached grades, divided into three general categories: (1) unbleached packaging and industrial converting grades such as wrapping, shipping sack, bag and sack, and other converting papers 18-lb and over; (2) bleached packaging and industrial converting grades; and (3) special industrial papers such as absorbent, cable, electrical and vulcanized fiber paper. The bleached grades also include glassine, greaseproof and parchment papers.

Unbleached grades account for close to 70% of total production, with bleached grades accounting for nearly 20% and special industrial around 10%. Demand for specific unbleached and bleached end-uses: bag and sack, 43%; shipping sack, 22%; wrapping, 5%; other converting 15%; glassine, greaseproof, parchment, 5%; and special industrial, 10%.

Kraft packaging and industrial converting papers are normally divided into four end-uses: (1) wrapping, (2) shipping sack, (3) bag and sack, and (4) converting papers. These grades are produced from unbleached kraft pulp, principally from softwoods, on fourdrinier paper machines.

Unbleached kraft papers are characterized by high-strength properties and the sheet surface is normally smoothed by calendering (MF, machine finish) or by yankee dryer (MG, machine glazed).

Kraft papers for bag and sack are made in a range of basis weights, 30 to 80 lb/3,000 ft^2 or 49 to 130 g/m^2. Unbleached kraft paper for grocery bags is made at weights of 30 lb to 40 lb, in 5-lb increments, whereas grocery sack paper is made in higher weights. Typical weights are 40, 52, 57, 65, 70, 75 and 80 lb. Standard weight is about 70-lb, while 40-lb is used in duplex grocery sacks. As a general rule, sack paper is made in weights of 40 lb or heavier.

If higher strength or toughness is required, extensible kraft papers are offered, but these papers are primarily made for multiwall bags and specialty papers. Paper capacity for extensible paper is estimated to be about 300,000 tons.

Bags are primarily made in four designs: (1) flat, (2) square, (3) satchel-bottom and (4) self-opening.

Since bags are made for many types of uses and in various sizes, paper stock requirements vary in weight and treatment and are tailored to each end-use. Most unbleached kraft papers are consumed in producing grocery bags and sacks.

Sacks are larger bags, usually the large size bags used by grocery stores and for packaging individual products such as dog food or sugar. Sacks are standardized in four sizes (1/8, 1/6, 1/5, and 1/4 of a bushel). Normally a heavier-weight kraft paper is used than for bags—40 lb to 80 lb, or 65 to 130 g/m^2. Sacks are divided into four classes: single-wall, heavy single-wall, double-wall or duplex, and multiwall.

Merchandise bags are smaller and more specialized types of bags, primarily used by nongrocery retail

U.S. STATISTICS FOR PACKAGING AND INDUSTRIAL CONVERTING PAPERS

	1985e	1984	1983
Production[1], 000 short tons	5,530	5,551	5,498
Capacity[1], 000 short tons	5,755	5,991	6,078
Utilization rate, %	96.0	92.6	90.4
Imports, 000 short tons	160	149	108
Exports, 000 short tons	260	275	261
Apparent U.S. consumption			
000 short tons	5,430	5,425	5,345
lb/capita	45.71	45.97	46.40
000 tons/$ billion real GNP (1972)	3.21	3.31	3.48

1. American Paper Institute

stores, such as department stores. Commonly, these are bleached and printed.

Multiwall sacks, or shipping sacks, are heavy-duty bags used to ship bulk products such as cement, chemicals, and agricultural products. Multiwall sacks are made up of two or more plies of sack paper. Sack papers are commonly laminated or coated with plastic film. There are two different paper weights that are used—50 and 60 lb.

INDUSTRY STRUCTURE

The structure of the packaging and industrial converting industry is fragmented because of the wide range of grades produced. Commodity unbleached kraft bag and sack paper grades are mainly produced at integrated mills in the southeastern U.S., where the industry first began to develop in the 1920s. Some unbleached kraft paper is also produced in the Pacific Northwest and in western and eastern Canada (see Canadian section below).

More specialized unbleached and bleached packaging and converting papers are made at integrated and nonintegrated mills mainly in the upper Midwest and northeastern U.S. Specialty and industrial papers are manufactured at small nonintegrated mills heavily concentrated in New York, Massachusetts and other northeastern states.

Low growth rates and poor profitability in the unbleached kraft segment are causing a major industry restructuring through machine shutdowns and divestitures. Champion International Corp. has become the largest producer through its acquisition of St. Regis Corp., but may divest some of its unbleached kraft assets. Stone Container Corp. has also become a much larger factor through its acquisition of Continental Forest Industries Inc.'s former unbleached kraft mills. Crown Zellerbach has substantially withdrawn from the business through the sale of its Port Townsend, Wash., mill to Haindl Papier of Fed. Rep. Germany.

In the specialty packaging and industrial paper sector, James River Corp. has expanded significantly over the past decade through the purchase of a number of small nonintegrated mills.

SUPPLY/DEMAND TRENDS

Production of packaging and industrial converting grades has shown the lowest growth rate for any major grade category over the past 15 years. Shipments rose from 5.2 million tons in 1970 to a peak of 5.9 million tons in 1979 and then declined to 5.3 million tons in the 1982 recession before recovering to 5.5 million tons in 1984, according to American Paper Institute and Bureau of the Census data. This resulted in average growth of only 1% annually over this period compared with 2.4% for all grades of paper and paperboard.

Demand trends have varied significantly among different grade segments, however, with shipments of unbleached paper grades showing a declining trend in recent years. Bleached packaging paper shipments have held relatively steady, while specialty and industrial papers have shown modest growth. Competitive inroads by plastic films into many packaging and industrial converting paper markets, plus stagnant industrial activity in the early 1980s, have been responsible for the lackluster performance.

Even though kraft packaging and industrial paper production is forecast to drop slightly in 1985, operating rates should rise to about 96% from 93% in 1984 and 90% in 1983 because of declining industry capacity. Most of this decline in capacity has been concentrated in the unbleached kraft segment of the industry where the important grocery bag and sack market is being threatened by plastic supermarket sacks. Planned future unbleached kraft paper capacity withdrawals, plus modest growth in bleached packaging and special industrial papers, should keep average operating rates for the packaging and industrial segment relatively high over the next several years.

KRAFT PACKAGING PAPERS

U.S. unbleached kraft paper shipments rose from 3.7 million tons in 1970 to a peak of 4.2 million tons in 1974 and then declined to 3.6 million tons in the 1982

U.S. TOTAL PRODUCTION AND CAPACITY OF PACKAGING AND INDUSTRIAL CONVERTING PAPER

(000 short tons)

	Production	Capacity	Utilization rate %
1987e	—	5,769	
1986e	—	5,754	
1985e	—	5,755	
1984	5,551	5,991	92.6%
1983	5,498	6,078	90.4
1982	5,300	6,076	87.2
1981	5,433	5,947	91.4
1980	5,327	6,072	87.7
1979	5,708	6,053	94.3
1978	5,778	6,146	94.0
1977	5,930	6,242	95.0
1976	5,661	6,202	91.3
1975	4,804	6,368	75.4
1974	5,732	6,360	90.1
1973	5,694	6,060	94.0
1972	5,706	6,028	94.7
1971	5,443	5,963	91.3
1970	5,438	5,940	91.6
1969	5,520	5,840	94.5

Source: American Paper Institute and Bureau of the Census.

recession. Shipments rebounded to nearly 3.7 million tons in 1983 and remained at about the same level in 1984, according to API data. Bleached packaging papers for the same end-uses have remained relatively stable at around 900,000 tons, according to Bureau of the Census statistics.

Unbleached kraft paper shipments are projected to drop about 1% in 1985, mainly due to losses to plastic in the grocery bag and sack market. Nevertheless, operating rates should rise to about 97% compared with 93% in 1984 because of the conversion or shutdown of four machines in 1984 and 1985. Georgia-Pacific Corp. in February 1985 phased out production on the second of two unbleached kraft paper machines with a combined capacity of 157,000.tpy at its Crossett, Ark., mill. International Paper Co. scheduled the phase out of production on one 135,000-tpy machine at its Mobile, Ala., mill in summer 1985. Both mills are being converted to bleached grades. Later in 1985 G-P is expected to complete the conversion of a 158,000-tpy kraft paper machine at its Monticello, Miss., mill to linerboard.

Further conversions should keep operating rates relatively high over the next several years. IP, for example, has indicated possible plans to shut down its Camden, Ark., mill unless certain concessions from workers and local government are obtained. Port Townsend Paper Corp. has indicated eventual plans to convert the Port Townsend, Wash., mill to bleached grades. And Union Camp Corp. is also considering conversion of a kraft paper machine at its Savannah, Ga., mill to corrugating medium.

Grocery bag and sack is the single largest end-use market for unbleached kraft paper. Production of grocery bag and sack paper showed fairly steady growth during the first two decades after World War II due to the rapid growth of supermarket chains which increased demands for large carryout sacks, probably somewhat at the expense of smaller bags. Shipments of grocery bag and sack, however, began to show signs of leveling off in the 1970s and have been fairly stable in recent years at about 2.2 million tons.

Based on consumer purchases of food, demand for grocery sack paper is highly stable and tends to track general population growth. Prices for grocery sack paper, however, are volatile and profitability in recent years has been poor. Price instability is caused by swing linerboard machines in the industry which shift to heavyweight kraft paper production in periods of weak demand. Some estimates put such capacity in the industry at around 1.0 million tons.

The price of 70-lb grocery sack paper dropped from $320 in the third quarter of 1981 to as low as $240 in 1982 before recovering to around $335 in the spring of

U.S. PRODUCTION AND CAPACITY OF PACKAGING AND INDUSTRIAL CONVERTING PAPER BY GRADES

(000 short tons)

	Unbleached kraft		Bleached kraft*		Special industrial paper	
	Production[1]	Capacity[1]	Production[2]	Capacity[1]	Production[2]	Capacity[1]
1987e	—	3,705	—	1,121	—	942
1986e	—	3,700	—	1,119	—	934
1985e	—	3,704	—	1,125	—	926
1984e	3,666	3,954	—	1,117	—	919
1983	3,666	4,065	902	1,119	804	894
1982	3,688	4,091	828	1,080	499	906
1981	3,881	3,991	923	1,091	485	865
1980	3,951	4,110	876	1,095	464	866
1979	4,096	4,098	993	1,105	531	850
1978	3,998	4,223	1,043	1,041	498	883
1977	3,936	4,317	1,002	1,069	524	856
1976	3,918	4,218	1,138	1,128	574	856
1975	3,374	4,333	965	1,194	440	841
1974	4,169	4,389	1,205	1,291	598	679
1973	3,902	4,138	1,205	1,292	610	629
1972	3,811	4,083	1,272	1,323	507	622
1971	3,649	4,031	1,242	1,383	438	549
1970	3,786	4,007	1,231	1,316	421	554
1969	3,780	4,006	1,297	1,275	443	559

* Includes glassine, greaseproof and vegetable parchment.

Source: 1. American Paper Institute; 2. Bureau of the Census.

1984. Weakness in linerboard demand was a factor in causing the price to drop back to the $310 level in early 1985. The concentrated purchasing power of major supermarket chains has also tended to keep the price of converted sacks low, making profitability of grocery sack papermaking and converting unsatisfactory in even the best of times.

Another factor probably holding back grocery sack, and in turn paper, prices in recent years has been competition from plastic bags. Plastics have begun to make significant inroads into the U.S. grocery sack market mainly as a result of two developments. The first is the widespread availability of a new generation of polymers such as linear low-density polyethylene (LLDPE) and high-molecular-weight high-density polyethylene (HMW HDPE) which makes it possible to downgauge sack walls by as much as 35% to 50% over conventional low-density polyethylene (LDPE). Second, overcapacity and fierce price competition among resin producers have kept resin prices depressed.

ESTIMATED CAPACITY OF U.S. COMPANIES PRODUCING PACKAGING AND INDUSTRIAL PAPERS

	Annual capacity (000 short tons)	Grades
1. Champion International[1]	710	Unbleached and bleached sack, bag and converting
2. Stone Container[2]	530	Unbleached sack, bag and converting
3. James River	490	Specialty packaging and industrial papers
4. Union Camp	430	Unbleached sack, bag and converting
5. Georgia-Pacific[3]	380	Unbleached and bleached bag, sack and converting
6. Longview Fibre	320	Unbleached and bleached sack, bag and converting
7. International Paper	295	Unbleached and bleached sack, bag and converting
8. Gilman Paper	247	Unbleached and bleached sack, bag and converting
9. Hammermill Paper	200	Unbleached and bleached specialty and industrial converting paper
10. Mead	150	Unbleached and packaging and industrial converting
11. Westvaco	140	Saturating kraft paper
12. Chesapeake	115	Unbleached bag and sack
13. Weyerhaeuser	110	Unbleached sack, bag and converting
14. Jacksonville Kraft	105	Unbleached bag and converting
15. Wausau Paper Mills	105	Glassine, greaseproof and specialty papers
16. Port Townsend Paper	100	Unbleached bag, sack and converting
17. Philip Morris Industrial	85	Specialty and industrial converting
18. Willamette Industrial	70	Unbleached bag and sack
19. Crown Zellerbach	70	Unbleached bag and converting
20. Shawano Paper Mills	50	Specialty and industrial
21. Hollingsworth & Vose	50	Specialty and industrial
22. Mosinee Paper[4]	40	Specialty and industrial
23. CPM	35	Specialty and industrial
24. Equitable Bag	35	Unbleached and bleached bag and sack
25. Kimberly-Clark	30	Specialty, saturating papers
26. Knowlton Brothers	30	Specialty papers, filter
27. Merrimac Paper	26	Specialty and industrial converting
28. Monadnock Paper Mills	26	Specialty and industrial converting
29. Chase Bag	22	Bag, sack and specialty paper

1. Includes St. Regis. 2. Includes Continental Forest Industries unbleached kraft mills. 3. Reflects conversion of kraft paper machine at Monticello, Miss., to linerboard. 4. Includes 50% interest in Schoeller Technical Papers.

Exact capacities for packaging and industrial grades are difficult to estimate because of swing machines in the industry which can produce either linerboard or unbleached kraft packaging paper. Estimates for specialty and industrial paper may include some printing/writing paper, thin paper or tissue tonnage.

U.S. PRODUCTION OF PACKAGING AND INDUSTRIAL CONVERTING PAPER—BY END USE[1]

(000 short tons)

	Wrapping paper			Shipping sack paper			Bag and other paper			Other converting paper		
	Total	Unbl	Other[2]	Total	Unbl	Other[2]	Total	Unbl	Other[2]	Total	Unbl	Other[2]
1983	155	90	65	846	727	119	2,027	1,860	167	597	388	209
1982	152	85	67	892	787	105	1,997	1,854	143	514	331	183
1981	183	103	80	1,085	967	118	2,188	2,012	176	675	340	176
1980	240	137	103	1,154	1,062	92	2,330	2,101	229	670	419	251
1979	306	187	119	1,212	1,110	102	2,365	2,115	250	786	499	287
1978	465	210	155	1,111	1,019	92	2,365	2,092	273	815	551	264
1977	354	218	136	1,180	1,073	107	2,516	2,212	304	794	558	236
1976	321	195	126	1,228	1,100	128	2,428	2,154	274	902	499	403
1975	280	165	115	974	879	95	2,166	1,938	228	752	417	335
1974	369	226	143	1,409	1,279	130	2,134	1,889	245	980	535	445
1973	425	267	158	1,176	1,072	104	2,196	1,942	254	1,057	599	458
1972	498	294	204	1,109	996	105	2,183	1,942	241	1,182	694	448
1971	491	285	206	1,078	976	102	2,146	1,911	235	1,084	591	493
1970	518	298	220	1,094	996	98	2,117	1,898	219	1,088	596	492
1969	574	345	229	1,123	1,023	100	2,018	1,791	227	1,146	621	525

[1] Excludes glassine, greaseproof, and parchment papers, and specialty industrial papers.

[2] Principally bleached kraft papers.

Source: Bureau of the Census (1981-83 based on shipments; prior years are for production).

The price of LDPE, for example, dropped from a peak of 35¢/lb to 28¢ in 1982 but had recovered to only about 30¢ to 32¢ in late 1984. New polyethylene production from Saudi Arabia and Canada should keep resin prices depressed over the next several years. These developments have now made plastic bags—often in a tee-shirt design with strap handles—lower in price than unbleached kraft paper grocery sacks.

Plastic sacks by 1984 had captured an estimated 8% of the U.S. supermarket carryout sack market—though far lower than many studies had projected at the beginning of the decade. One reason for the slower than expected penetration could be that total supermarket costs for using the plastic bags are higher because of the greater checker time required to load them, according to a recent Case & Co. study commissioned by the American Paper Institute. Consumer preference appears to be divided on the two types of sacks, with urban shoppers preferring plastic bags with handles and suburban shoppers favoring self-standing paper sacks.

Nevertheless, the outlook is for continued plastic growth at the expense of paper in the grocery sack market. Plastic penetration will probably reach 12% to 13% in 1985 and perhaps 25% to 30% by the late 1980s. Mobil Corp. has been an aggressive marketer of the new plastic bags in the U.S. and Union Carbide Corp. is a more recent entry. A number of paper companies are hedging their bets by making plastic bags; they include Union Camp, Sonoco Products Co. (which does not make paper sacks), Georgia-Pacific, Champion, Union Camp and Trinity Bag and Paper Co. Inc.

Shipping sack is the second largest use after grocery bag and sack for unbleached kraft paper. Production has shown gradual growth over the past several decades, exceeding the 1.0-million-ton level for the first time in

U.S. EXPORT AND IMPORT TRENDS FOR PACKAGING AND INDUSTRIAL CONVERTING PAPERS

(000 short tons)

	Exports[1]	Imports
1984	275	149
1983	261	108
1982	263	80
1981	303	94
1980	331	86
1979	227	143
1978	173	138
1976	356	56
1974	340	142
1972	183	148
1970	188	64

1. Includes special industrial paper and glassine, greaseproof and parchment.

Source: American Paper Institute and Bureau of the Census.

U.S. PRODUCTION OF UNBLEACHED KRAFT PACKAGING AND INDUSTRIAL CONVERTING PAPERS

(000 short tons)

	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972
Total	**3,391**	**3,308**	**3,586**	**3,718**	**3,911**	**3,872**	**4,061**	**3,949**	**3,399**	**3,929**	**3,879**	**3,927**
Wrapping[1]	90	85	102	137	187	210	218	195	165	226	266	294
Shipping sack	727	787	967	1,062	1,110	1,019	1,073	1,100	879	1,279	1,072	996
Bag and sack[2]	1,859	1,854	2,012	2,101	2,115	2,092	2,212	2,154	1,938	1,889	1,942	1,942
Grocer	—	—	—	2,074	2,085	2,064	2,182	2,108	1,892	1,802	1,825	1,854
Other	—	—	—	27	30	29	30	46	46	87	117	88
Other converting, total	388	331	340	419	499	551	558	499	417	535	599	694
Asphalting	—	—	—	176	215	173	179	167	131	134	150	165
Other creping	—	—	—	40	25	22	14	6	6	13	17	25
Envelope stock[3]	—	—	—	—	—	—	—	—	—	—	—	—
Gumming stock	—	—	—	63	80	51	66	68	61	83	90	96
Twisting/spinning stock[3]	—	—	—	—	—	—	—	—	—	—	—	—
Waxing stock[3]	—	—	—	—	—	—	—	—	—	—	—	—
Other	—	—	—	105	141	271	266	173	155	213	233	307

1. All colored or natural brown MF and MG, including treated and untreated butcher papers.
2. Other than shipping sacks.
3. Data not available or withheld.

Source: Bureau of the Census.

the early 1970s, according to API statistics. Production of unbleached shipping sack paper in the 1982-84 period has averaged around 880,000 tons, reflecting the depressed state of such major end-use sack markets as agriculture and construction.

Another reason for the decline in tonnage may be a general reduction in the weight of paper required to make multiwall sacks. Champion International (St. Regis) in 1982 started up a new 240,000-tpy machine which produces an improved air-dried multiwall kraft paper with greater strength and stretch. The "Stress Kraft" paper permits sack converters to eliminate a ply for a basis-weight reduction of at least 18% and get the same performance as with a regular sack. The new technology is causing some other producers to upgrade their regular flat kraft and extensible paper machines.

The suspicion that some loss in tonnage may be due to a general reduction in paper weight used in multiwall sacks is supported by Paper Shipping Sack Manufacturers Assn. statistics which show that unit shipments of sacks rose 2% in 1983 and 7% in 1984.

Multiwall shipping sack paper has traditionally been sold at a price premium to other grades of heavyweight kraft paper. This reflects the fact that shipping sack paper must meet higher specifications, is often produced in smaller runs, is finished in a wide range of roll widths and is frequently shipped in less than maximum-weight rail cars. Nevertheless, weakness in heavyweight grocery sack paper prices has caused more producers to try to make multiwall paper and this has caused pressure on prices.

Producers tried to raise the price of 50-lb multiwall paper by $30 to $440/ton in early 1984, but the price increase never took full effect and by the fall had dropped down to $390/ton—only slightly above its 1982 recession low. The outlook for shipping sack paper demand in 1985 is not particularly bright because of the financial squeeze in the farm economy, which will

U.S. PRICE TRENDS FOR SELECTED UNBLEACHED KRAFT PAPER GRADES

($/short ton)

Annual averages	Shipping sack *50-lb	Grocery sack *70-lb
1984	$410	$335
1983	395	250
1982	381	260
1981	401	305
1980	371	272
1979	328	243
1978	296	220
1977	288	199
1976	271	209
1975	266	220
1974	220	199

* Reflects discounting from list prices.

Source: PULP & PAPER PRICEBOOK.

MAJOR U.S. UNBLEACHED KRAFT PAPER CAPACITY WITHDRAWALS

Completed	Mill	Capacity (short tpy)	Date
Gulf States Paper	Tuscaloosa, Ala.	167,000	1978
Crown Zellerbach	Bogalusa, La.	140,000	1979
Boise Southern	Elizabeth, La.	105,000	1981
Manville Forest	West Monroe, La.	35,000	1981
St. Regis	Lufkin, Texas	100,000	1981
Georgia-Pacific	Crossett, Ark.	157,000	1984-85
Total past withdrawals		704,000	
Scheduled			
Georgia-Pacific	Monticello, Miss.	158,000	1985
International Paper	Mobile, Ala.	135,000	1985
Announced future withdrawals		293,000	
Possible			
International Paper	Camden, Ark.	255,000	n.a.
Haindl Paper	Port Townsend, Wash.	100,000	n.a.

n.a. = Not available.

probably affect demand for fertilizer and animal feed, two major end uses for sacks. Longer run, however, shipping sack paper production will probably grow at 0.5% to 1% annually.

The major competitive threat to shipping sacks is from bulk handling or packageless methods of shipping materials. Some competition also may come from all-polyethylene shipping sacks, which have penetrated perhaps 6% to 8% of the U.S. market. Most paper multiwall sacks, however, incorporate a layer of polyethylene and take advantage of both materials.

Other bag and sack paper has been in a long-run declining trend due to heavy competition from plastics. The paper garment bag, for example, was replaced by plastic film in the 1960s.

Merchandise bags were next to face plastic competition, although the market transition did not really accelerate until late in the 1970s with the advent of low-cost high-density polyethylene resins. Plastic has now captured an estimated 40% to 50% of the retail merchandise bag market. Paper manufacturers have given up these markets without much of a fight, perhaps because the lighter weight (typically 30 to 35 lb), more specialized paper required for such bags has been less profitable to produce.

Unbleached **wrapping paper** has lost about 65% of its market since 1970 to plastic films. The slippage in bleached wrapping grades is somewhat less, but here also more than 50% of the tonnage has been eroded away. Shipments for unbleached and bleached wrapping papers each total about 100,000 tons annually. For the short term, further significant slippage in wrapping paper demand is not expected to occur, since films have already displaced paper in its most vulnerable market areas. It is unlikely that films can continue to displace wrapping papers, especially in such areas as butcher papers and for parcel post packaging.

Converting papers. Demand for converting paper grades, both unbleached and bleached, have declined about 45% over the past 15 years. Waxing, and to a lesser degree gumming, stock has lost tonnage, again principally because of competition from plastic film bases. Further slippage in tonnage can be anticipated for grades which are in direct competition with plastic films or used in mature industries such as automobiles, rubber and steel.

U.S. PRODUCTION OF MAINLY BLEACHED PACKAGING AND INDUSTRIAL CONVERTING PAPERS[1]

(000 short tons)

	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972
Total[1]	**902**	**828**	**922**	**674**	**759**	**784**	**783**	**931**	**774**	**964**	**975**	**1038**
Wrapping	65	66	80	103	119	155	136	126	115	143	158	204
MG/MF[2]	—	—	—	95	109	127	122	109	100	121	133	171
Miscellaneous	—	—	—	8	10	28	15	17	15	22	25	33
Shipping sack	119	105	117	92	102	92	107	128	95	130	104	105
Rope and combination[3]	95	—	84	—	—	—	—	29	27	39	22	23
Other	24	—	34	—	—	—	—	99	68	91	82	82
Other bag and sack	168	143	176	229	250	273	304	274	228	245	254	241
Grocer	122	105	124	155	170	217	198	153	133	144	169	168
Other	46	38	51	73	80	55	106	121	.95	101	85	73
Other converting[4]	209	183	163	251	287	264	236	403	355	445	458	488
Envelope stock	—	—	—[5]	—[5]	—[5]	—[5]	—[5]	130	99	135	130	126
Gumming stock	—	—	—	32	34	23	14	12	10	11	13	13
Twisting/spinning stock	—	—	—	—	—	—	—	—	—	9	10	11
Waxing stock	157	136	120	98	113	76	69	117	97	117	138	141
Cup stock	—	—	—	—	—	—	—	—	—	34	35	48
Other[6]	52	47	47	52	59	115	100	207	94	139	132	148

1. Excluding unbleached, glassine, greaseproof and parchment papers. Principally bleached kraft paper but can include sulfite and other-fiber-based papers.
2. All MG and MF wrapping papers, treated and untreated butcher papers.
3. Includes unbleached and bleached sulfite and kraft and combinations of each.
4. Over 18 lb.
5. For 1977-83 kraft envelope included in fine sheet papers, "Book converting papers."
6. Such as asphalting, creping stock, etc.

Source: Bureau of the Census.

AVERAGE VALUE OF U.S. EXPORTS AND IMPORTS FOR PARCHMENT, GREASEPROOF PAPERS AND GLASSINE

($/short ton)

	Exports	Imports
1983	1,067	$1,453
1982	1,330	1,498
1981	1,187	1,686
1980	1,148	1,578
1979	1,008	1,020
1978	833	948
1977	807	879
1976	739	849
1975	445	872
1974	655	731
1973	651	616
1972	812	581
1971	727	417
1970	671	417

Source: Commerce Dept.

One segment that has been showing moderate growth in recent years is saturating kraft paper used to make decorative laminates such as Formica. Although cyclical, demand for saturating kraft has had a long-term growth rate of around 3%/year in the U.S. and consumption in 1984 was estimated at between 150,000 to 180,000 short tons. The two most important regular U.S. suppliers are Westvaco Corp. from its Charleston, S.C., mill and Union Camp Corp. from its Savannah, Ga., mill. Quality requirements for this grade are strict in regard to cleanliness, porosity, and density.

SPECIAL INDUSTRIAL PAPERS

Specialty industrial papers are a broad group of papers used by industry for conversion into other products. These papers may be laminated to synthetic films or paper, bonded, coated or saturated with resins. Examples include abrasive paper, electrical insulation, filter paper and similar grades.

Production of specialty papers has increased gradually since 1970 and currently totals about 500,000 tons, according to Bureau of the Census data. API shows capacity of about 925,000 tons. However, since it is difficult to define these grades and to separate them from other converting paper stocks, production figures are not necessarily a good indication of trends for

PRODUCERS OF VEGETABLE PARCHMENT, GLASSINE, GREASEPROOF PAPERS

		Location	Grades	Capacity[1] (tpd)
1.	James River Corp.			
	Riegel Products Corp.	Milford, N.J.	Glassine, greaseproof	200
	KVP Group	Parchment, Mich.	Vegetable parchment	120
2.	Wausau Paper Mills Co.			
	Rhinelander Paper Co.	Rhinelander, Wis.	Glassine, greaseproof	300
3.	Philip Morris Industrial			
	Nicolet Paper Co.	De Pere, Wis.	Glassine, greaseproof	140
4.	Eddy Forest Products	Espanola, Ont.	Vegetable parchment, greaseproof	115
5.	Reed International Ltd.			
	Deerfield Specialty	Nixon (Augusta), Ga.	Glassine, greaseproof	55
	Monroe Bridge, Mass.	Monroe Bridge, Mass.	Glassine, greaseproof[2]	
6.	Domtar Inc.	St. Catherines, Ont.	Glassine, greaseproof, vegetable parchment	230
7.	Simkins Industries Inc.			
	Westfield River Paper	Lee Mass.	Glassine, greaseproof	15
		Russell, Mass.		50

1. Most listings include substantial quantities of other specialty grades.
2. Mill was shutdown in late 1984 although employees hoped to reopen it.

special industrial paper grades. Some types of industrial papers have lost market share, especially in areas in which plastic and synthetic products can penetrate—such as in resin-impregnated stocks. However, the demand for filter grades continues to expand. In turn the pricing for most grades appears fairly strong.

GLASSINE, VEGETABLE PARCHMENT AND GREASEPROOF

These unique grades of papers have smooth, glass-like surfaces and are transparent. They find use in the protective packaging of foods, drugs, tobaccos, soaps, etc. They are also used for the windows of envelopes, in drafting and reproduction papers, and for a variety of other uses.

Glassine is produced from sulfite pulp, beaten and refined to a very low freeness (drainage). This slow-draining pulp forms a dense sheet on a fourdrinier paper machine. Glassine is calendered with a supercalender to give it gloss. The standard basis for glassine is 24x36 in., 500 sheets. Typical wieghts are 20, 25, 30, 40, 50 lb.

Vegetable parchment is prepared by treating a sheet of paper with sulfuric acid followed by washing and drying. The resulting sheet has, as the name implies, a "parchment" feel and appearance. These papers are manufactured plain or treated. Special treatments are waxes, lacquers, printing, embossing, laminating, metallic coatings, and others.

Glassine and greaseproof papers have been under severe competition from plastic films and have lost many of their traditional markets. Production of these papers has been static over the past 15 years at around 200,000 tons and in the future will probably show a gradual decline.

U.S. PRODUCTION, EXPORTS AND IMPORTS OF PARCHMENT, GREASEPROOF PAPERS AND GLASSINE

(000 short tons)

	Production	Exports	Imports
1983	209	17	8
1982	206	5	6
1981	176	9	5
1980	202	8	4
1979	234	8	5
1978	259	8	5
1977	219	5	3
1976	207	10	3
1975	191	11	2
1974	240	8	3
1973	230	4	3
1972	234	3	2
1971	206	3	2
1970	203	3	3
1969	216	—	—

Source: Bureau of the Census and PULP & PAPER WEEK DATABOOK.

U.S. PRODUCTION OF SPECIAL INDUSTRIAL PAPERS

(000 short tons)

	1983[1]	1982[1]	1981[1]	1980[1]	1979[1]	1978[1]	1976	1975	1974	1973	1972	1971
Total	**804**	**737**	**485**	**464**	**531**	**498**	**524**	**573**	**440**	**598**	**610**	**507**
Abrasive paper	—	—	—	—	—	—	7	*	*	*	*	*
Cable paper	—	—	—	—	—	—	10	*	3	6	5	9
Electrical insulation[2]	—	—	—	—	—	—	20	17	14	28	29	25
Pressboard[3]	—	—	—	—	—	—	*	*	*	*	*	*
Absorbent paper	—	—	—	—	—	—	74	77	61	84	72	55
Blotting paper	—	—	—	—	—	—	3	4	3	7	9	6
Filter paper	—	—	—	—	—	—	71	73	58	77	63	49
Matrix paper and board	—	—	—	—	—	—	*	*	2	5	7	8
Vulcanizing-fiber stock	—	—	—	—	—	—	18	18	12	25	28	26
Resin-impregnated stock	—	—	—	—	—	—	89	97	76	80	113	101
Others	—	—	—	—	—	—	276	303	243	330	317	249

* Data withheld to avoid disclosing figures for individual companies.

1. Data for individual grades not available for 1978-83.

2. Includes armature paper and paperboard.

3. Includes imitation pressboard.

Source: Bureau of the Census.

CANADIAN KRAFT PAPER INDUSTRY

The past decade has been difficult for the Canadian kraft paper industry because of declining tariff protection and competition from plastic film. Production has declined from a cyclical peak of 643,000 metric tons in 1974 to about 485,000 tpy in 1983 and preliminary statistics show that output declined about 10% in 1984.

Until 1980, a 15% tariff wall protected Canadian kraft paper producers, but this is scheduled to disappear entirely by 1987 under GATT negotiations completed in the late 1970s. The eastern Canadian industry was mainly built to serve the Canadian domestic market and is not particularly cost competitive. The western Canadian industry, however, is highly export oriented, with several large efficient mills such as Prince George Pulp & Paper Ltd., Eurocan Pulp & Paper Co. Ltd. and Manfor Ltd. Total Canadian exports of kraft paper outside North America have totaled about 170,000 metric tons in recent years although they dropped sharply in 1984.

Plastics have captured about 50% of the Canadian grocery bag and sack market over the past decade. This market penetration, however, is very uneven, with plastic capturing almost all of the Ontario market but only about 20% of the Quebec market. Nevertheless kraft grocery sack paper shipments have gone down about 35% over the past decade.

Plastics have also made more of a penetration into shipping sacks in Canada and account for about 30% of the market. Shipments of multiwall kraft paper have declined by about 28% over the past decade and in 1984 totaled about 180,000 metric tons.

In the last five years, two Canadian mills have ceased production of kraft paper, taking about 75,000 tons off the market as they shifted to other products.

Production of kraft paper will probably continue to decline in the future, although several producers are modernizing their mills.

CANADIAN PRODUCTION AND CAPACITY FOR KRAFT PAPERS

(000 short tons)

	Production	Capacity	Utilization rate, %
1986e	—	622	—
1985e	—	615	—
1984	475p	612	77.6%
1983	534	611	87.4
1982	514	622	82.6
1981	576	642	89.7
1980	599	619	96.8
1979	677	680	99.6
1978	692	686	100.1
1977	613	684	89.6
1976	580	688	84.3
1975	475	706	67.3
1974	709	701	101.1
1973	671	663	101.2
1972	597	628	95.1
1971	540	—	—
1970	493	—	—
1969	514	—	—

e = Estimate
p = Preliminary

Source: Canadian Pulp & Paper Assn.

ESTIMATED CAPACITY OF CANADIAN COMPANIES FOR KRAFT AND SPECIALTY PAPERS

(000 short tons)

	Annual capacity	Grades
1. Eurocan Pulp & Paper Co.	130	Unbleached bag, sack, wrapping
2. Mantor Corp.	130	Unbleached bag, sack
3. Prince George Pulp & Paper	110	Bleached and unbleached sack, bag
4. Cascades	70	Unbleached & bleached bag, wrapping
5. Crown Forest Industries Ltd.	45	Bag, wrapping, converting
6. Eddy Forest Products Ltd.	45	Bleached bag, sack, converting, wrapping
7. Consolidated-Bathurst Inc.	35	Unbleached bag, converting, wrapping, specialty
8. Domtar Inc.	30	Bleached and unbleached bag, sack, converting, wrapping
9. J. Ford	16	Kraft wrapping and specialty paper

TISSUE

GRADE STRUCTURE

Tissue is a lightweight grade of paper used for sanitary, packaging and cleaning purposes, and sold both to individual consumers and industrial and commercial establishments. Some major tissue producers also make feminine napkins and disposable diapers, converting both sanitary napkin stock and fluff pulp.

Sanitary tissue includes bathroom tissue, facial tissue, toweling, paper napkins, sanitary napkins and wipes. It is designed with consumer appeal in mind, and is disposable, absorbent and bulky. The two major sectors of the sanitary tissue business are consumer or resale tissue and commercial and industrial (C&I) tissue.

C&I tissue is sold to commercial business sites, industrial plants and institutions. The difference between consumer and C&I products can be minimal, although generally C&I tissue buyers are less interested in such factors as appearance and softness, and are primarily concerned with roll size and economy.

Other tissue refers to products such as wrapping tissue, waxing tissue stock, pattern tissue stock and creped wadding. These grades can be made with a glazed surface.

Basis weights vary widely, ranging from as low as 12 lb (20 g/m²) to 39 lb (63 g/m²), based on a ream of 24x36 in., 500 sheets.

OUTLOOK

Tissue is partly shielded from recessionary downturns and post-recession booms, since consumers rarely buy less facial or bathroom tissue or toweling simply because times are tough. Their buying preferences can be influenced by perceptions of economic conditions, however, something which was demonstrated by the swing to generic and private label products in the 1970s, a swing caused by inflation and consumer desire to economize on price.

With the return of economic health in the mid-1980s, however, private label/generic market shares levelled off and, in some end-uses, even dropped slightly. It is thought unlikely that consumers will return to these low-priced products in huge numbers unless inflation and economic stagnation once again become prolonged facts of life.

While consumer tissue consumption levels are largely tied to population trends, C&I tissue is heavily influenced by economic factors such as construction, travel and the tendency of consumers to eat out at restaurants or stay at home. With the recession of 1980 pinching consumers in the pocketbook, operating rates fell from the 92.8% of 1979 to 88.3% in 1980. Rates were depressed by a 4.5% fall in shipments just as the industry was trying to absorb 1979's 4.9% capacity increase.

Then when a second recession followed in a little over a year, operating rates remained depressed. The industry ran at just about 89.7% in 1981 and 86.6% in 1982 before rising back over the 90% level—to 92.4% in 1983 and about 93% in 1984.

Goldman Sachs & Co. security analyst Bruce Kirk believes that primary sanitary tissue production will rise from 4.74 million tons in 1984 to 4.8 million in 1985 and 4.95 million in 1987. Consumption will rise from 4.93

U.S. STATISTICS FOR TISSUE

	1983	1984	1985e
Production, 000 tons*	4,789	4,875	4,923
Capacity, 000 tons	5,190	5,243	5,322
Utilization rates, %	92.3	93.0	92.5
Imports	12	28	25
Exporfts	16	17	18
Apparent U.S. consumption			
000 tons	4,785	4,886	4,930
lb/capita	41.0	41.5	41.5
000 tons/$ billion real GNP	3.11	2.98	2.92

* All tons are short tons.
e = PULP & PAPER estimate.

million tons in 1984 to 5.14 million tons in 1987.

Capacity rose very little in the early 1980s, which enabled the industry to push through a modest price increase in early 1984—its first in more than two years. Indeed, by the estimates of Smith Barney, Harris Upham & Co. analyst George Adler, capacity in 1982 and 1983 rose by just about 1%/yr and he made a similar forecast for 1984. At the same time, production in 1983 rose 7.9%, and Adler was estimating that the production increase in 1984 would be about twice the increase in capacity during that year. The groundwork was clearly being laid for a healthy 1985.

But even with good operating rates in 1983 and 1984, pricing was not as firm as it had become in most other paper grades. "Only in facial tissues and disposable diapers did price realizations in 1983 advance over 1982, a clear indication of substantial discounting that still occurred in 1983," in Adler's view.

Also, price increases announced in the first quarter of 1984 were not across the board: Scott Paper Co. went up 5% to 6% for towels, but Procter & Gamble Co. did not follow suit. Private label prices went up by the same amount, but only in the West—in the East they didn't go up at all. C&I transaction prices advanced by a little more than half of the 6% to 7% announced increases. Generally speaking, list prices for facial tissue went up by about 5% and for bathroom by about 9%, while diaper prices were hiked by as much as 6.5%. It is clear, however, that these list price increases were reduced somewhat by continued promotional activity.

Pointing to the slowness in price improvement, Adler adds that "while this is disappointing since prices have not moved since fall 1981, there is barely a brand that has not reduced its sheet counts in the last two years, which, of course, is a hidden price increase."

Helping to retard the pace of price increases, in Adler's view, was the unevenness of capacity utilization throughout the industry. In 1984, he said, Scott, Crown Zellerbach Corp., James River Corp. and Kimberly-Clark Corp. appeared to be running full-out "and, in some cases, are buying parent rolls," while "Fort Howard, Georgia-Pacific, Potlatch and Procter & Gamble have excess capacities."

A prolonged period of flat or depressed pricing has been seen before in the industry. In 1980-81, aggressive discounting by most consumer tissue producers and reluctance to raise prices on the part of frequent price leader P&G resulted in an 18-month period when list prices remained unchanged. Indeed, between June 1980 and June 1981, prices for toilet tissue dropped by 2% according to Bureau of Labor Statistics figures.

That period ended in September 1981 when a 7% P&G

U.S. PRODUCTION AND CAPACITY OF SANITARY PAPER AND TISSUE PAPER

(000 short tons)

	Production[1]	% change	Capacity[2]	% change
1986	—	--	5,494	3.2
1985	—	—	5,322	1.5
1984	4,873e	1.8	5,243	1.0
1983	4,789	7.9	5,190	1.3
1982	4,438	−1.7	5,125	1.8
1981	4,518	0.6	5,035	1.6
1980	4,474	−2.8	4,954	1.4
1979	4,601	8.9	4,885	5.1
1978	4,245	0.0	4,644	2.1
1977	4,243	2.7	4,545	1.0
1976	4,129	7.3	4,500	1.5
1975	3,846	−4.4	4,432	2.5
1974	4,024	1.7	4,322	0.4
1973	3,956	−1.6	4,303	−0.3
1972	4,024	3.6	4,318	1.1
1971	3,881	2.9	4,267	1.9
1970	3,768	5.3	4,185	8.0
1969	3,575	—	3,873	—
Average 1975-84		2.0%		1.9%

e = PULP & PAPER estimate.

[1] Source: Bureau of the Census. Total of sanitary paper and tissue paper.

[2] Source: American Paper Institute.

CANADIAN PRODUCTION AND CAPACITY FOR TISSUE AND SANITARY PAPERS

(000 short tons)

		Capacity	
	Production[1]	Sanitary papers	Other tissue
1986	—	537	20
1985	—	535	20
1984	441	508	20
1983	424	495	20
1982	413	500	21
1981	430	474	21
1980	406	414	23
1979	399	401	23
1978	368	403	24
1977	342	404	22
1976	335	385	25
1975	283	372	28
1974	361	353	27
1973	324	349	23
1972	312	344	20
1971	289	—	—
1970	240	—	—
1969	281	—	—

[1] Excludes special papers.

Source: Canadian Pulp & Paper Assn.

price increase was matched by other major producers. And that was the last price increase anywhere in the industry until early 1984.

Despite this four-year record of only two price increases, the industry learned to protect its earnings by reducing both sheet count and the mills' salary load. Reduced staff and a passion for efficiency became the name of the game in most companies in the early 1980s. Thus the industry may be prepared for a possible bulge of excess capacity that some observers see coming in 1986 and 1987.

Goldman, Sachs & Co. analyst Bruce Kirk told the September 1984 "Advanced Forming/Bonding Conference" of Marketing/Technology Service Inc., in Rye Brook, N.Y., that the industry's average operating rate should fall from 92.5% in 1985 to 89.7% in 1986 and just 89.1% in 1987, due to planned increases in year-end capacity of 4.7% in 1986 and 2.2% in 1985.

That bulge in capacity "should not be unduly troublesome," Kirk believes, and he noted that "the major expansion increments over the 1984-87 period are by existing producers with large positions in the industry and are not by outsiders likely to cause dislocation in order to establish position."

George Adler, however, warns that planned capacity increases "look dangerously high," and said that the risk of excess capacity is large, "particularly if the economy is weaker" in 1986.

But Adler also cautions that "it is not a foregone conclusion that 1986 will be a bad year for the tissue industry." For one thing, the actual startup dates of two planned new machines—James River's Naheola, Ala., installation and a new unit set by Crown Zellerbach for South Glens Falls, N.Y.—could be later than expected.

Also, Adler estimates that about 175 of the 230 tissue machines in the U.S., representing about 55% of capacity, have a rated capacity of less than 100 tpd. About a quarter of industry capacity is represented by machines of 50 tpd or less. "While some machines may in time be upgraded and speeded up, some of this capacity is clearly ready for the scrap heap," he concluded.

For example, Goldman Sach's Kirk noted in an October 1984 research report that Fort Howard planned to shut down two small units at Green Bay, Wis., in connection with startup of the new 250 tpd No. 10 unit at that mill. One of the two small (40- to 60-tpd) machines had already been shut down and the other was set for the scrap heap after No. 10 "has progressed further on its learning curve."

MARKETS

Sanitary tissue represents about 96% of the tissue industry, and toilet tissue and toweling each make up about a third of the total sanitary and nonsanitary tissue market. These and other sanitary tissue products are sold as finished goods in cases, converted by the paper manufacturer, and very little tonnage is sold as "parent rolls" to nonpapermaking converters who turn the rolls into finished products.

Most consumer tissue products are sold under brand names of major companies, with the most significant players in terms of 1983 retail dollar sales of tissue, diaper and sanitary napkin products being (in descending order) P&G, Kimberly-Clark, Scott, James River, Georgia-Pacific Corp., Johnson & Johnson, Tambrands Inc. and Crown Zellerbach. Branded products represent about 80% of retail tissue sales, with the other 20% being "generic" and "private label"—predominantly store brands.

Private label and generic products, lower in price than branded goods, gained market share steadily during the late 1970s, but since the recession of 1981-82 they seem to have leveled off in most product areas. Taken together, the

U.S. PRODUCTION OF TISSUE PAPER, EXCLUDING SANITARY AND THIN PAPER

(000 short tons)

	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974
Tissue paper[1]: total	110	106	114	176	198	210	197	193	178	224
Wrapping tissue	(D)	(D)	(D)	72	63	74	74	61	47	44
Waxing tissue stock	(D)	(D)	(D)	24	31	32	28	37	39	49
Twisting tissue stock	—	—	—	13	14	12	9	8	7	10
Fruit, vegetable wraps	—	—	—	—	—	—	—	—	—	—
Pattern tissue stock	—	—	—	—	—	—	—	—	—	—
Creped wadding[2]	(D)	(D)	(D)	25	41	37	35	30	34	46
Other tissue paper	20	21	25	18	21	29	28	30	22	41

[1] Excluding sanitary and thin
[2] Creped wadding for interior padding
(D) — Data withheld to avoid disclosing figures for individual companies.

Source: Bureau of the Census.

two product types (private label and generic) represent about a fifth of bathroom tissues, slightly more than that in facial, about a quarter of the toweling market and about a third of the napkin market. In diaper and sanitary napkin products, they tend to constitute a negligible portion. And in no area do private label and generic products appear to be gaining market share; indeed, branded product producers appear to have been successful at combatting the lower-price group through their own "value brands" and continued product innovating, such as form-fitting diapers with reusable tabs.

A survey of supermarket, drug and mass merchandise outlets, published in *Private Label Magazine* in March 1984, for example, showed that sales of private label paper products in 1983 rose by just 2%, with generics showing a "modest increase." But on the other hand, the survey also showed that 89% of the retailers "predicted their store brand paper product sales to increase in the next year. The average expected gain was almost 10%."

The survey also showed that one tactic adopted by national brand producers to combat private label and generic products may have backfired. "Non-advertised brands such as Summit, Ecco and Hi-Dri, created by the brand manufacturers to gain back lost share to private label, have failed for the most part," with the percentage of food chains offering non-advertised brands falling by a quarter between 1983 and 1984. "Retailers indicated that non-advertised brand sales hurt national brand sales more than [private label] sales because consumers don't see them as great a value as private label. As a result, consumers have been trading down from national brands to the lower-priced Summit, Ecco and Hi-Dri."

One other tactic adopted by branded producers may have had an impact on the private label/generic sector, however. The magazine found that "the price spread between private label and national brand paper products declined to 15.5% [in 1984], as compared to a spread of 17.7% last year," while the spread for generics dropped from 27.7% to 26.1%. The reason for this closing of the gap between the two types of product was promotional activity by national brand producers.

Brand-name manufacturers generally manufacture for their own use only, but a few such as G-P also sell tissue products to supermarket chains and other private-label marketers. Potlatch Corp. and others sell only under private labels, and Weyerhaeuser Co. has emphasized selling to private label diaper manufacturers.

Selling to private-label marketers solves one of the major problems faced by tissue manufacturers—the exorbitant cost of sales associated with high promotional and distribution costs. Brand-name producers engage in highly sophisticated test-market activities, in which a new product is typically rolled out in a few local markets for several months of consumer reaction, and then gradually introduced through the rest of the nation—a process that can take several years and cost millions of dollars.

U.S. PRODUCTION OF SANITARY TISSUE

(000 short tons)

	1983	1982	1981[1]	1980	1979	1978	1977	1976	1975	1974
Sanitary paper: total	4,337	4,185	3,917	4,298	4,403	4,036	4,045	3,936	3,669	3,799
Toilet tissue	1,742	1,679	1,533	1,706	1,772	1,629	1,605	1,578	1,422	1,415
Single-ply	941	962	944	939	978	939	877	933	828	834
Multi-ply	802	717	588	766	794	690	729	645	594	581
Facial tissue	292	277	298	370	376	383	365	359	374	395
Napkin	594	532	474	532	533	429	370	448	436	439
Single-ply	467	407	341	409	404	317	353	342	334	345
Multi-ply	127	125	133	123	129	116	117	106	102	93
Toweling[1]	1,449	1,433	1,253	1,439	1,482	1,376	1,388	1,335	1,230	1,308
Sanitary napkin wadding	99	113	116		86	73	73	53	69	
Wiper stock[2]	60	56	129	251	240	57	48	52	62	55
Other sanitary stock	99	94	114			76	96	90	89	119

[1] Excludes wiper stock but includes facial tissue stock for towels.
[2] Regular, facial, and wadding type.

Source: Bureau of the Census.

The cost of introducing new products is rising rapidly, partly because of pressures to discount and the heavy expense associated with advertising and distribution, and also because of the necessity to bring out an innovative and distinctive product. Product research is a major investment for firms such as P&G, Scott, K-C and Crown Zellerbach, which are particularly interested in the premium end of various tissue markets.

Some producers avoid the rough-and-tumble of national-scale, premium-product marketing, and stick with regional sales. One such is Marcal Paper Mills Inc. in the East. To survive, mills of this kind have to win a solid following in medium- and low-cost tissue markets.

PRICE TRENDS FOR TISSUE PRODUCTS

(year-end prices)

	Toilet tissue ($/case)	Napkins, industrial ($/1,000 sheets)
1983[2]	21.00	3.88
1982[1]	25.60	3.88
1981[2]	23.95	3.42
1980	24.69	2.36
1979	21.56	2.76
1978	20.01	2.53
1977	18.52	2.33
1976	17.37	2.19
1975	16.19	2.06
1974	14.52	1.88
1973	9.80	1.32
1972	9.31	1.18
1971	9.31	1.14
1970	9.36	1.09

[1] PULP & PAPER WEEK estimate for July.

[2] Figure for May, since second-half figures unavailable or considered unreliable.

Source: PULP & PAPER PRICEBOOK. PULP & PAPER WEEK estimates based on Bureau of the Census data.

The commercial and industrial segment of the industry is dominated by Fort Howard Paper Co., with about 30% of the estimated 1.4-million-tpy C&I market. Second most important producer is Scott Paper, which has about 13% of the market, by one estimate, while Crown Zellerbach, with about 9%, is also an important factor.

The dominant grade on the consumer side is bathroom tissue, but in the C&I sector toweling is the major grade. Fort Howard has the widest range of product lines, while Scott and Crown both also offer a big variety of products. Some others concentrate in one or two areas. Wisconsin Tissue Mills, for example, concentrates in napkins, although its newest machine is also able to produce bathroom tissue and toweling.

Other tissue includes a small but important group of specialty grades used for wrapping, cushioning, packaging and packing. Most significant—and also the only grade to show an increase in production in recent years—is wrapping tissue. Producers of these grades typically use small, old machines, on which they can also make industrial wipes, but they cannot compete in consumer tissue markets. As specialty tissue makers, however, they can often operate profitably within a narrow niche so long as they can pass on increased raw material and manufacturing costs.

TECHNICAL DEVELOPMENTS

The manufacture of tissue and towel products is very interesting from a technology viewpoint. Tissue and towel producers are always striving for new techniques to upgrade quality or reduce cost. This is particularly true in the high-quality grades where chemical modification, through-drying, layering, and innovative mechanical web modification techniques are employed.

In general, there are two types of sanitary tissue products being offered: high-priced, high-performance products, and lower-priced conventional sheets. High-priced, high-performance tissue is made by low-density forming techniques which yield substantial reductions in fiber costs per case of tissue.

In the conventional tissue process, water is removed on either a short fourdrinier (typically a suction breast roll

U.S. MARKET INDICATORS FOR TISSUE PRODUCTS

	1983	1982	1981	1980	1979	1978	1977	1976	1975
Facial tissue billions, two-ply tissues	190	188	183	179	181	181	180	182	177
Disposable household towels billions, jumbo rolls	2.2	1.9	1.8	1.8	1.7	1.6	1.5	1.5	1.4
Bathroom tissue billions, rolls	7.7	6.9	6.8	6.7	6.6	6.5	6.3	5.8	5.3

Source: Kimberly-Clark Corp., 1983.

unit sometimes having an inclined table) or a twin-wire former to form a coherent web of fibers. The fibers bond upon contact during drying. Because conventional papermaking fibers are short, there is little or no physical entanglement of the fibers, and almost all of the web's strength comes from bonding.

The wet-compacted web is normally dried on a yankee dryer from which it is creped off and guided onto conventional dryers or to a winder. This results in a high-density web. Thus, the softness of the conventionally formed web is reduced, not only because its stiffness is higher due to increased interfiber bonding, but also because the compressibility of the web is decreased as a result of the increased web density.

Nonetheless, machine speeds are very high. For example, 7,000 fpm operating speeds are now on the horizon for Kimberly-Clark's modified Crescent former, and twin-wire formers are now operating over 6,000 fpm and design speeds are over 6,500 fpm. Machines equipped with through-dryers that produce low-density sheets will operate at much lower speeds.

Layered technology is another technique used to enhance the qualities of the final product. Here the headbox is designed to separate the jet into layers, with each layer having its own furnish. Layering allows sheet bulk to be increased, thus lowering sheet count per roll. The ability to concentrate the various fibers in different layers allows producers to obtain improved sheet characteristics.

In addition to the advanced wet-end technology employed, there has been extensive activity designed to improve softness without degrading strength. Paper webs are conventionally softened by working them, such as by embossing, calendering, or creping them from an adhering surface with a creping blade. Such processes disrupt and break many of the interfiber bonds. A variety of different creping and embossing methods are used in varying combinations. Often these methods are used on each ply, and then the plies are combined.

Chemical web modification and chemical additives have also been used. For example, additives to enhance the rate of water pickup have been added. A number of chemical softening techniques have been tried which involve modification of fiber-to-fiber bonding characteristics.

Machines. Because of evolving technology and different grade requirements, all machines, even at a given mill, will not be the same. Twin-wire machines have been running conventional and low-density products for several years. The older machines of more or less conventional design typically will make napkin, lower-quality toilet tissue, or facial grades. A towel machine will be different from a toilet tissue machine. Also, converting methods vary greatly from producer to producer and have a considerable effect on the final product. Existing machines often use elements of new technology, such as surfactant addition, to make quality gains without mechanical changes.

Soft tissue. The basic strategy behind "soft" low-density tissue lies in avoiding compaction during the papermaking process. Pneumatic methods are used to remove water, and

ESTIMATED CAPACITIES FOR TISSUE OF MAJOR PRODUCERS

(000 short tons)

	Annual capacity				
	U.S.	Share of U.S. capacity (%)	Canada	Share of Can. capacity (%)	Company total
1. Scott Paper Co.	1,035	19.4	143	26.7	1,178
2. Procter & Gamble Co.	900	16.9	—	—	900
3. Fort Howard Paper Co.	620	11.6	—	—	620
4. James River Corp.	560	10.5	—	—	560
5. Georgia-Pacific Corp.	510	9.6	—	—	510
6. Kimberly-Clark Corp.	400	7.5	80	15.0	480
7. Potlatch Corp.	300	5.6	—	—	300
8. Crown Zellerbach	285	5.4	—	—	285
9. Erving Paper Mills	130	2.4	—	—	130
10. APL Corp.	95	1.8	—	—	95
11. Pope & Talbot Inc.	95	1.8	—	—	95
12. Wisconsin Paper Mills Inc.	91	1.7	—	—	91
13. Dominion Cellulose[1]	—	—	90	16.8	90
14. Marcal Paper Mills Inc.	85	1.6	—	—	85
15. Statler Tissue Corp.	79	1.5	—	—	79
16. Eddy Forest Products	—	—	66	12.3	66

U.S. annual capacity (1985): 5.322 million tons
Canadian annual capacity (1985): 0.535 million tons

[1] Subsidiary of CIP Inc.

the porous sheet enters the dryer section at about 25% consistency (vs 40% when using mechanical pressing).

This means a much greater thermal load and more drying than a yankee can be expected to handle by itself. Further, a yankee requires intimate contact with the sheet to achieve maximum drying rates. Conventionally, the sheet is pressed onto the yankee at about 300 psi, causing compaction. To avoid this, various through-drying schemes are used before and after the yankee to preserve bulk and achieve higher drying rates. A whole array of machine configurations have emerged, but, in general, substantial through-drying is necessary for low-density products.

Some technologies do away with the yankee altogether, and creping is done on smaller creping rolls. Machines are now running which use only through-drying.

Since this process avoids conventional pressing, hydrogen bonding is reduced and therefore so is tensile strength. Thus, soft processes generally require higher-quality furnish with long, lightly refined fiber.

For instance, one company reportedly uses roughly 50% kraft and 50% sulfite fiber. Other companies use blends of hardwood and softwood kraft pulps with or without sulfite fiber. The stuffbox freeness may be over 600, with refining used primarily to meet specific grade requirements.

Recycled fiber is used extensively in lower-quality sheets, and can consist of large amounts of groundwood. Recently commercial offerings in the mid- to high-quality range, utilizing through-drying techniques, have also incorporated substantial amounts of recycled fiber in the furnish.

Air-laid forming is becoming an increasingly viable commercial option and several products are available in the marketplace based on this technology. Initially machine speeds were slow and the resultant machine economics were unfavorable. Most air-laid tonnage is produced in Europe.

Recently a great deal of work has gone into the development of bonding air-laid webs. Initially binders such as latex were applied to bond the fibers together. The trend is to use heat and pressure methods, called thermal bonding, which apply a discrete pattern using an embosser. The development of new fibers, several incorporating more than one material, have aided in these advances. These bicomponent fibers have a low-melting-temperature polymer surrounding a core consisting of polymer with a high melting point.

DIAPERS, SANITARY NAPKINS AND INCONTINENCE PRODUCTS

Major end-uses for sanitary and absorbent paper products appear to be maturing following the hectic pace of recent years, with the exception of the still-developing adult incontinence market. Disposable diapers for incontinent adults appear to be the one big growth market for the industry in the next few years.

These were among the conclusions presented by speakers at a series of "Insight '84" conferences held by Marketing/Technology Service Inc. Subjects of the three back-to-back meetings were absorbent products, adult incontinence, and developments in forming and bonding technology.

Paper companies have three main interests in these products areas: producing fluff pulp or wadding for diapers and sanitary napkins, making the actual converted product such as the diaper or the napkin, and now, increasingly, producing nonwoven materials for purposes such as diaper coverstock. The actual diapers and napkins are made from fluff pulp, generally softwood kraft but sometimes including

TISSUE EXPANSIONS

Year	Company	Mill	Annual capacity (000 short tons)
Announced			
1984	Cascades Inc.	Rockingham, N.C.	16
1984	Fort Howard Paper	Green Bay, Wis.	88[1]
1984	Scott Paper Ltd.	New Westminster, B.C.	36
1985	Tagsons Papers Inc.	Mechanicville, N.Y.	14
1986	Crown Zellerbach	S. Glens Falls, N.Y.	56
1986	Fort Howard Paper	Muskogee, Okla.	80
1986	James River Corp.	Naheola, Ala.	70
1986	Little Rapids[2]	Potsdam, N.Y.	50
Proposed or under study			
n.a.	Crown Zellerbach	South (possibly Bogalusa, La.)	n.a.
n.a.	Fort Howard	South	n.a.
n.a.	Wisconsin Tissue	Menasha, Wis.	n.a.

1. Replacing one or two paper machines rated at about 17,000 tpy each.
2. Idle tissue machine acquired from Kimberly-Clark Corp.'s Kapuskasing, Ont., mill.
n.a. = Not available.

hardwood kraft or sulfite. A few diaper manufacturers are beginning to experiment with superabsorbent materials. Diaper coverstocks are frequently made from latex, polyester or polypropylene.

But even with the intense interest of paper companies in these product areas, there are no reliable estimates of the present or potential size of many of the markets involved.

Baby diaper sales. John Starr, a Boston, Mass.-based consultant, told delegates that the $2.1 billion baby diaper market grew by 8% in unit terms in 1983 and probably rose from 15 billion units in that year to more than 16 billion in 1984. He expects it to reach 20 billion, or sales of more than $4 billion, by 1990.

On the other hand, the nascent but fast-growing adult diaper market—only $200 million in 1983, by Starr's estimate—is projected to more than triple, to over $700 million, by 1990. By contrast, he estimates the feminine pad market rose just 7% in 1983 in dollar terms, and tampon sales were up only 1%.

Another market that, like adult diapers, is still growing at double digit rates is the resale business in premoistened wipers. Starr places those sales at $190 million in 1983, up by 18% from the previous year. Most observers expect this market to show less future growth than adult diapers, however. Many wipers are pulp-based nonwoven products, although there has been some market penetration by carded fabrics.

Adult diaper market potential. One reason the industry is so bullish on the adult incontinence market is that some observers have estimated that as many as 7% of the population may be potential customers. But James Hanson, director of M/TS, pointed out in a presentation in one of the conferences that many projections of potential demand are predicated on unrealistically high estimates of the number of daily changes typical for incontinent persons. Actually, there are many types of incontinence problems, and diapers must be designed specifically for each one.

That variety and complexity was stressed by several speakers, who made it clear that the adult diaper market at present is less likely to develop as a commodity market than will the baby diaper business. In fact, specific products require fairly extensive engineering, and thus the market may necessitate smaller production runs than for some other paper-product industries of this potential size.

Indeed, Hanson also pointed out that the baby diaper market is becoming increasingly complex as well, with product innovations proliferating and the number of competitors growing rapidly. In fact, because of "excess capacity and severe competitive fever," Hanson believes that "price warfare will break out by spring [1985]" in the baby diaper market.

Fluff pulp end-uses. Even so, Hanson and others made it clear that both baby and adult diapers can be a profitable and growing business for some mills. Rainer Roos, sales manager of Finncell Ltd., told the delegates he believes the potential in Europe for fluff pulp for some of these products is also great.

Between 1984 and 1990, for example, the fluff pulp market in western Europe should grow from 761,000 metric tons to 980,000 tons. Baby diapers currently take 81% of western Europe's fluff pulp, but that is projected to fall to 76% in 1990. Adult incontinence products should rise from 6% to 13%. Sanitary napkins will use about 11% of western Europe's fluff pulp, down from 13% in 1984.

Future growth rates will vary by product type. Roos projects baby diaper growth at 3.3%/yr through 1990 and sanitary napkins at just 2%, while incontinence products should shoot up by 17%/yr. Baby diaper demand is closely tied to population increases, since market penetration of disposable diapers is very high in most countries (99% in Sweden, 98% in France, 95% in Finland and a little over 80% in Fed. Rep. Germany, for example, compared to about 75% for North America).

On the other hand, adult products are still new to the general population, and growth rates will top 20%/yr in some countries until the market matures. Indeed, Roos believes that while "the starting level is very low...by 1990 incontinence products are estimated to overtake the sanitary products market in pulp consumption."

EUROPEAN TISSUE MARKET

European tissue demand is much smaller than U.S. consumption, and rose about 4% to 2.5 million metric tons in 1983. European manufacturers expect growth rates to settle out at about 3%/yr for the balance of the decade—a steep decline from the nearly double-digit growth rates of 20 years ago. Capacity addition has not slowed down as fast as consumption, however, and overcapacity is expected to continue to be a problem for several years.

Fed. Rep. Germany is the largest consumer in western Europe. Together with the United Kingdom, France and Italy, it constitutes two-thirds of total demand. The highest per capita consumption, however, is in Sweden; at 18.1 kg it is only slightly below the U.S. rate of about 18.6 kg. By contrast, per capita consumption in Portugal is just 2.8 kg.

PAPERBOARD

Paperboard is a general term describing heavyweight grades of paper used for containers, boxes, cartons and packaging materials. Paperboard is divided into three major classes: (1) containerboard, (2) boxboard, and (3) other paperboard.

Containerboard is the largest single grade of paperboard produced and includes three major grade categories: (1) linerboard, (2) corrugating medium, and (3) chip and filler boards. Most of these grades are made from virgin kraft fiber on a fourdrinier paper machine. The bulk of containerboard produced in the U.S. is consumed by domestic corrugated container plants, but a substantial proportion of linerboard, nearly 2.1 million tons in 1984, is exported.

Boxboard grades include (1) folding boxboard, (2) setup boxboard, and (3) foodboard. Folding boxboard is paperboard that is die-cut to be folded into a carton. These cartons are used to package dry cereals, soap powders, pet foods, and other commonly used consumer products. Folding boxboard is made from layers (plies) of recycled fiber on a multi-ply machine, or from bleached kraft pulp on a fourdrinier paper machine. Normally it is coated to improve printability for enhanced consumer appeal.

Setup boxes are rigid or open boxes ready to receive a product. Major uses are for shoes, jewelry, and candy.

Foodboard is normally produced from bleached kraft pulp on a fourdrinier paper machine. There are a

MARKET INDICATORS FOR PAPERBOARD CONSUMPTION

	Paperboard consumption (million tons)	Gross National Product	Personal consump. expenditures Durable	Nondurable (billions of 1972 constant $)	Industrial production index	Manufacturing capacity utilization
1983	28,985	1,535	156	376	148	n.a.
1982	26,409	1,485	140	364	139	70%
1981	28,741	1,514	141	363	151	76
1980	27,716	1,475	136	358	147	78
1979	29,250	1,479	147	349	152	83
1978	28,335	1,439	146	343	146	84
1977	27,150	1,370	138	330	138	82
1976	26,744	1,298	126	320	131	80
1975	23,311	1,232	113	307	118	74
1974	26,799	1,246	113	304	129	84
1973	27,590	1,254	122	309	130	88
1972	26,279	1,186	111	299	119	83
1971	23,938	1,122	98	288	108	80
1970	23,495	1,086	89	283	106	81
1965	20,301	926	73	244	90	86
1960	15,475	737	53	208	66	—

Source: U.S. Dept. of Commerce, American Paper Institute data.

number of grades, each specifically coated, waxed, or otherwise treated to handle moist or oily food products. Typical grades are milk cartons, frozen food packages, ice cream cartons, cupstock, and plates.

Other paperboard includes kraft or recycled paperboard made on either cylinder or fourdrinier paper machines. These paperboards are used for fiber cans, core or drum stock, liners for gypsum board, as well as chipboard ("cardboard") used for pad backings or for packing flat cloths or other articles.

U.S. paperboard production in 1984 totaled 34.4 million short tons—almost exactly equal in tonnage to paper production at 34.4 million tons but lower in value, according to American Paper Institute data. On a value-of-shipments basis, paper shipments in 1982 (latest available Bureau of the Census data) were $20.2 billion, while paperboard shipments were about $9.3 billion—although values for both have rebounded strongly in the last couple of years since then.

Containerboard is the most important paperboard grade segment, with 1984 production for domestic use totaling 20.9 million tons. Boxboard output for the domestic market is 6.0 million tons, and all other types of paperboard total 4.8 million tons. Paperboard exports, with linerboard and solid bleached board by far the most important categories, totaled nearly 3.0 million tons in 1981. About 78% of U.S. paperboard is

CANADIAN EXPORTS OF PAPERBOARD[1]

(000 short tons)

	Linerboard	Corrugating medium	Boxboard
1983p	310	197	63
1982	213	158	31
1981	295	170	37
1980	361	201	40
1979	288	157	39
1978	283	177	54
1977	393	105	20
1976	318	90	7
1975	198	53	11
1974	414	96	22
1973	311	140	23
1972	222	147	17
1971	173	133	22
1970	201	102	13
1965	123	46	16

p = Preliminary.

[1] Canadian imports of paperboard are minor. For example, in 1982, Canada imported less than 40,000 tons of containerboard.

Source: Canadian Pulp & Paper Assn.

U.S. PRODUCTION OF BOXBOARD AND OTHER PAPERBOARD FOR DOMESTIC USE

(000 short tons)

	BOXBOARD—DOMESTIC USE				OTHER*
	Total	Folding	Setup	Milk carton & food service	
1983	6,261,000	4,646,000	256,300	1,388,800	6,742,700
1982	5,841,000	4,333,700	223,600	1,283,700	5,716,900
1981	6,216,100	4,587,600	236,000	1,392,500	5,976,100
1980	6,153,100	4,489,900	241,500	1,421,700	6,729,000
1979	6,469,200	4,720,500	306,000	1,442,700	6,135,000
1978	6,501,200	4,702,400	332,700	1,466,100	5,865,500
1977	6,332,200	4,546,700	302,500	1,483,100	5,453,500
1976	6,564,700	4,714,600	331,500	1,518,600	5,174,500
1975	5,663,800	3,896,400	304,500	1,462,900	4,505,700
1974	6,399,000	4,426,500	403,600	1,568,900	5,748,900
1973	6,764,300	4,704,500	465,300	1,594,500	5,879,200
1972	6,551,000	4,439,800	455,100	1,656,100	5,932,500
1971	6,233,600	4,139,400	447,900	1,646,300	5,450,400
1970	6,238,700	4,079,700	466,500	1,692,500	5,180,000
1965	5,811,200	3,879,600	547,300	1,384,900	4,321,200
1960	4,894,900	3,291,200	525,100	1,078,600	2,845,000

* Including exports.

Source: American Paper Institute.

U.S. SHIPMENTS OF PAPERBOARD GRADES, 1983-79

(000'short tons)

	1983	1982	1981	1980[1]	1979[1]
TOTAL PAPERBOARD	31,470	28,912	30,566	31,143	31,168
SOLID WOODPULP FURNISH PAPERBOARD	24,235	22,145	23,950	23,901	23,585
Unbl kraft packaging, industrial converting	15,825	14,390	15,707	15,285	14,903
Unbleached linerboard	14,763	13,297	14,431	14,249	13,857
Tube, can, and drum paperboard	99	151	334	220	232
Other, incl. corrugating medium	962	941	942	(D)	(D)
Bleached packaging, industrial converting (80% bl. fiber)	4,070	3,757	4,070	4,034	4,065
Linerboard	113	101	120	(D)	(D)
Folding carton type board	1,924	1,743	1,921	2,063	2,045
Milk carton board	1,060	1,052	1,085	1,023	1,066
Heavyweight cup stock	509	418	427	386	375
Plate, dish, and tray stock	255	227	245	273	260
Bleached paperboard for miscellaneous packaging	18	32	49	33	46
Other solid bleached board	190	184	222	78	94
Semichemical paperboard, incl. corrugating medium, other	4,340	3,998	4,173	4,583	4,617
RECYCLED PAPERBOARD	7,054	6,607	6,616	7,242	7,583
Recycled shipping containerboard	2,206	2,097	1,750	2,070	2,050
Linerboard	494	505	250	518	460
Corrugating medium	1,545	1,427	1,315	1,281	1,301
Container chip and filler board	167	165	185	271	290
Recycled folding carton board	2,293	2,153	2,425	2,350	2,386
Unlined chipboard	599	546	(D)	606	678
Kraft-lined	157	146	176	81	98
White-lined	172	152	189	220	229
Clay-coated	1,364	1,308	(D)	1,443	1,380
Recycled setup paperboard	244	238	298	560	604
Recycled packaging, industrial converting board	2,311	2,119	2,144	2,262	2,543
Tube, can and drum stock	841	767	808	564	628
Gypsum linerboard	700	598	634	1,036	1,210
Panelboard and wallboard stock	148	119	100	113	137
Other	622	635	601	548	568
WET MACHINE BOARD	181	172	[2]	138	144
CONSTRUCTION PAPER AND BOARD	3,263	2,781	1,460[3]	4,390	5,436
Construction paper	477	447	616	1,369	1,868
Sheathing paper (red rosin, asphalt, house sheathing)	(D)	(D)	(D)	3	14
Felts, saturating and dry					
Roofing felts	(D)	(D)	510	1,205	1,633
Other felts incl. floor covering	(D)	(D)	(D)	(D)	(D)
Asbestos paper and asbestos-filled (e.g., electrolytic)	(D)	(D)	(D)	62	100
Other building paper (saturating screenings, etc.)	(D)	(D)	(D)	(D)	(D)
Structural insulation board	—	—	—	3,021[4]	3,569[4]
Insulating board	653	593	845	1,051	1,263
Hardpressed board	2,133	1,741	(S)	1,970	2,306

(D) Data withheld to avoid disclosing figures for individual companies.
(S) Suppressed because the data did not meet publication standards of the Bureau of the Census.
[1] Reported as production by Bureau of the Census prior to 1981.
[2] Wet machine board included with recycled paperboard to avoid disclosing figures for individual companies.
[3] Excludes hardboard.
[4] Insulation and hardpressed board.

Source: Bureau of the Census.

U.S. PRODUCTION OF CONTAINERBOARD FOR DOMESTIC USE

(000 short tons)

	CONTAINERBOARD	LINERBOARD			CORRUGATING MATERIALS			Chip & filler boards
	Total	Kraft	Recycled	Total	Semichem & kraft	Recycled	Total	
1983	19,173.0	12,835.6	289.1	13,124.7	4,532.7	1,305.4	5,838.1	210.2
1982	17,507.5	11,656.5	279.0	11,935.5	4,202.5	1,139.3	5,341.8	230.2
1981	19,040.4	12,754.3	324.2	13,078.5	4,561.2	1,140.9	5,702.1	259.5
1980	18,070.2	11,948.6	444.5	12,393.1	4,398.5	1,047.1	5,445.6	231.5
1979	18,824.8	12,417.3	402.3	12,819.6	4,573.6	1,202.3	5,775.9	229.3
1978	17,908.2	11,877.2	256.4	12,133.7	4,305.3	1,197.7	5,503.1	271.5
1977	17,167.3	11,354.4	341.3	11,695.7	4,128.2	1,079.7	5,207.9	263.7
1976	16,700.2	11,093.2	282.7	11,375.9	3,986.5	1,075.1	5,061.5	262.9
1975	14,586.2	9,646.9	207.3	9.854.2	3,579.4	870.0	4,449.3	282.6
1974	16,767.0	10,838.4	467.1	11,305.4	4,010.3	1,169.0	5,179.2	282.3
1973	16,928.1	11,066.9	289.1	11,355.9	4,126.5	1,128.5	5,255.0	317.1
1972	16,019.0	10.577.6	278.9	10,856.5	3,874.2	972.3	4,846.5	315.9
1971	14,353.0	9,249.1	281.7	9,530.8	3,580.2	939.5	4,519.7	302.5
1970	13,964.3	9,133.4	269.7	9,403.1	3,404.7	859.3	4,264.0	297.2
1965	11,199.1	6,698.1	782.5	7,480.6	2,638.2	800.0	3,438.2	280.3
1960	8,186.6	4,731.2	743.6	5,474.8	1,788.9	672.1	2,461.0	250.8

Source: American Paper Institute and Fibre Box Assn.

U.S. PRODUCTION AND CAPACITY OF PAPERBOARD

(000 short tons)

	Production[1]		Capacity[1]		Utilization rate(%)
	(000 tons)	% change	(000 tons)	% change	
1986	—	—	36,853	1.4%	—
1985	—	—	36,332	0.9	—
1984	—	—	35,992	1.1	—
1983	31,951	9.9%	35,603	0.5	89.7%
1982	29,065	-6.9	35,421	2.8	82.1
1981	31,232	0.9	34,466	1.6	91.2
1980	30,952	-1.9	33,709	0.8	91.8
1979	31,429	3.8	33,436	2.5	94.0
1978	30,275	4.6	32,631	1.4	92.8
1977	28,953	1.8	32,173	0.2	90.0
1976	28,439	14.8	32,097	2.8	86.0
1975	24,756	-14.4	31,218	0.7	79.3
1974	28,915	-2.2	30,995	1.5	93.2
1973	29,571	3.8	30,543	1.3	96.8
1972	28,502	9.5	30,147	5.5	94.5
1971	26,037	2.6	28,576	3.5	91.1
1970	25,383	-3.8	27,619	-0.8	91.9
1969	26,376	—	27,837	—	94.8
Average 1970-83		1.6		1.7	

e = Estimate.

[1] Excludes capacity for hardpressed boards, wet machine boards and construction papers and boards.

Source: American Paper Institute (1983 capacity survey).

made from mainly solid woodpulp furnish, while 22% is recycled board made from wastepaper.

The Canadian paperboard industry is much smaller, with total output in 1984 of roughly 2.7 million short tons, according to preliminary Canadian Pulp & Paper Assn. statistics. Linerboard is by far the most important grade, with 1981 output at around 1.2 million tons, while corrugating medium production totaled about 650,000 tons and total boxboard production amounted to 813,000 tons. Canadian paperboard capacity has been fairly flat over the past decade and the future outlook for production is not bright because of the scheduled gradual lowering of tariff barriers which will make imports from the U.S. more competitive.

CANADIAN PAPERBOARD CAPACITY

(000 short tons)

	LINERBOARD		CORRUGATING MEDIUM		SOLID BLEACHED BOARD	BOXBOARD Folding, others[1]
	Kraft	Recycled	Semichem	Recycled		
1986e	1,001	333	601	164	99	798
1985e	998	327	595	166	98	784
1984e	987	323	583	168	98	769
1983	952	315	581	129	98	747
1982	969	300	564	150	104	732
1981	1,069	322	557	129	102	770
1980	1,056	289	545	114	105	785
1979	1,074	267	520	115	137	832
1978	1,069	272	517	116	135	812
1977	1,300	278	510	116	131	757
1976	1,374	221	455	93	116	709
1975	1,311	153	443	87	108	712
1974	1,262	135	437	74	105	648
1973	1,141	116	422	61	100	618
1972	817	103	406	62	97	598
1971	811	124	422	68	119	585

[1] Includes mill wrappers but excludes solid bleached board

Source: Canadian Pulp & Paper Assn., May 1983

CANADIAN PAPERBOARD PRODUCTION

(000 short tons)

	CONTAINERBOARD		BOXBOARD				TOTAL
	Liner board	Corrugating medium	Folding	Non-folding	Bleached board	Other	PAPER-BOARD
1983e	1,113	544	356	140	—[1]	386	2,537
1982	965	473	312	125	—[1]	326	2,202
1981	1,190	572	444	143	—[1]	283	2,632
1980	1,127	505	428	132	—[1]	264	2,555
1979	1,142	498	455	136	—[1]	291	2,524
1978	1,113	451	400	149	—[1]	280	2,392
1977	1,014	375	368	147	—[1]	239	2,142
1976	1,047	379	356	114	—[1]	206	2,103
1975	782	339	297	103	—[1]	183	1,704
1974	1,203	463	259	165	120	367	2,577
1973	1,104	494	268	131	93	426	2,515
1972	925	457	277	120	116	245	2,140
1971	797	389	258	115	98	214	1,871
1970	776	373	250	111	107	233	1,850
1965	595	251	265	104	89	250	1,553
1960	375	208	233	65	14	172	1,067
1955	259	158	186	48	—	219	869
1950	214	152	158	48	4	204	708

e = Estimate.

[1] Included in Boxboard, folding.

Source: Canadian Pulp & Paper Assn.

LINERBOARD

Linerboard is a commodity grade of paperboard used in the production of corrugated containers. Linerboard is used as the top and bottom facing (liner) placed over corrugating medium to form the rigid structure of the combined board. Linerboard provides the strength component of a container, while corrugating medium provides rigidity or stiffness.

Unbleached linerboard is made in a wide range of basis weights. The standard kraft liner is 42 lb/1,000 ft^2, but other important grades are produced in weights of 26, 33, 38, 69, and 90 lb.

Normally, linerboard is produced in two plies—top and bottom liners. The bottom liner, comprising up to 85% of the fiber furnish, is made from high-yield kraft, whereas the top liner, applied with a secondary headbox, is made from a higher quality pulp (either of lower yield or else highly refined) with better sheet properties to permit an adequate level of printing quality at container plants.

Also, to improve printability, starch is applied to the liner at a size press. Linerboard may be treated internally with sizes and wet-strength agents to develop desired sheet properties. About 4% of all linerboard produced in the U.S. is wet-strength treated. Each weight of linerboard is controlled, normally by refining, to give a minimum burst strength (mullen).

Kraft linerboard is made predominantly from softwoods (southern pine, Douglas fir, and eastern pines and spruces) but it may also contain some hardwood kraft pulp. Proposed alternative transportation specifications for corrugated boxes will permit increased use of less expensive hardwood fiber (see below for further discussion of Rule 41).

Use of wastepaper fiber in kraft linerboard has also been growing, increasing from 4% of total fiber furnish in the late 1970s to around 8% currently. The principal wastepaper grades used are recycled corrugated containers (old corrugated) and new double-lined kraft cuttings. Usage varies, with the maximum wastepaper use by any kraft linerboard mill generally not over 25% of total fiber furnish.

A few U.S. mills produce linerboard from 100% wastepaper, called "test" linerboard, either on fourdrinier or multi-ply cylinder machines. Test liner is made in the 85- to 100-lb burst range. Production of recycled linerboard in the U.S. in recent years has hovered around 300,000 tons.

Inland Container Corp. is building the first new mill in the U.S. specifically designed for producing recycled linerboard. The 175,000-tpy facility in Ontario, Calif., is scheduled for startup in 1985. And International Paper Co., a major virgin kraft linerboard producer, recently announced plans to acquire a recycled linerboard mill in Riegelsville, Pa. These moves indicate that recycled linerboard may achieve greater importance in the U.S. market (see Recycled Paperboard section for additional information on test liner).

PRODUCTION TRENDS

Kraft linerboard is produced at large integrated kraft pulp and paper mills. These mills are located primarily in the U.S. South (about 83% of total U.S. capacity) and West, with a small amount of capacity also being located in eastern Canada and British Columbia.

Over 93% of linerboard sold is unbleached. Linerboard that is bleached is sold as either solid bleached board or as white top board, made by adding a thin layer of bleached fiber to the top of an unbleached sheet. This is also referred to as "mottled white" linerboard and accounts for about 6% of total linerboard production. Solid bleached liner production in the U.S. has been around 100,000 tpy—or less than 1% of total linerboard output.

In most cases, linerboard is produced on wide (220-in. or more) conventional fourdrinier paper machines at speeds of 1,000 to 2,000 fpm. Linerboard is sold in rolls, the size of the roll being determined by corrugator width. Chesapeake Corp. is currently installing the first linerboard machine in the U.S. with multiple-forming sections. The 320,000-tpy machine, scheduled for startup in late 1985, will permit greater flexibility in fiber furnish and is expected to produce a highly uniform three-ply sheet.

Kraft linerboard mills are often integrated with other pulp and paper operations. For example, about 20 U.S. mills also produce semichemical corrugating medium and a large number of mills produce sack and bag kraft paper grades. Some machines have capacity to "swing" from kraft sack and bag grades into lighter-weight linerboard. Such swing capacity in the U.S. industry has been estimated at around one million tons and makes exact industry capacity difficult to calculate.

The efficiency of kraft mills varies considerably and consequently so does the economics of manufacturing linerboard. For example, large, modern linerboard mills (such as those of International Paper at Mansfield, La., or Union Camp Corp. at Montgomery, Ala.) can produce more than 5.0 tons of linerboard per man-day, while some older, less efficient mills built in the South before World War II might produce only 1.5 tons.

Of course, older mills have the advantage of lower depreciation and interest costs. The cost of building a new world-scale greenfield 1,000-tpd linerboard mill in 1984 dollars would be more than $350 million. The cost of adding a new machine might be one-third to one-half this amount. This compares to around only $40 or $50 million for building a then-economic-size 600-tpd or 700-tpd linerboard mill in the 1960s.

The most important variable cost in producing linerboard is wood, which accounts for about 30% to 40% of total manufacturing cost. Wood costs vary in the South, and are highest in such areas as northeastern Florida, southeastern Georgia and northern Louisiana, which have the largest concentration of mills and the most competition for pulpwood supplies.

Mills using wastewood residuals from sawmills normally have a lower wood cost base than mills relying on pulpwood logs. But residual-based mills can also face

U.S. STATISTICS FOR UNBLEACHED KRAFT LINERBOARD

	1985e	1984	1983
Production, 000 tons	16,225	16,050	15,001
Capacity, 000 tons	16,723	16,488	16,217
Utilization rates, %	97.0	97.3	92.5
Imports, 000 tons[1]	50	70	48
Exports, 000 tons[2]	1,950	2,000	2,281
Apparent U.S. consumption			
000 tons	14,325	14,120	12,768
lb/capita	119.8	119.3	109.0
000 tons/$ billion real GNP	8.59	8.62	8.32

e = Estimate.

1. Department of Commerce data.

2. American Paper Institute (production for export)

U.S. PRODUCTION AND CAPACITY OF UNBLEACHED LINERBOARD

(000 short tons)

	Production[1]		Capacity[2]		Operating rate
	Tonnage	% change	Tonnage	% change	
1986e	—	—	17,003	2.0%	—
1985e	—	—	16,430	1.5	—
1984e	—	—	16,430	1.0	—
1983	15,007	11.2%	16,266	1.5	92.3%
1982	13,494	−7.2	16,032	4.3	84.2
1981	14,540	2.2	15,372	5.2	94.6
1980	14,232	2.0	14,586	2.7	97.6
1979	13,951	5.5	14,199	2.4	98.3
1978	13,228	5.2	13,864	1.9	95.4
1977	12,573	2.6	13,586	1.4	92.5
1976	12,251	12.4	13,448	2.4	91.1
1975	10,635	−10.6	13,138	1.8	80.9
1974	12,333	−3.7	12,901	0.3	95.6
1973	12,536	4.4	12,862	2.3	97.5
1972	12,335	9.1	12,568	6.5	98.1
1971	11,308	3.0	11,797	0.6	95.9
1970	10,982	0.3	11,718	—	93.7

e = Estimate.

1. Source: American Paper Institute and Bureau of the Census.

2. Source: American Paper Institute.

chip shortages and high fiber costs when sawmill operating rates are low due to depressed housing starts. Mills on the West Coast, which are heavily dependent on residuals, faced such a wood supply squeeze and severe cost pressure in 1980-81 and as a result have increased their capability to process low quality logs.

MARKET STRUCTURE

Most linerboard produced in the U.S. goes into domestic corrugated container production. About 14% to 15% is exported overseas and a small amount goes into miscellaneous uses such as tube, can and core stock.

Corrugated box shipments closely track industrial production and over the past decade have grown at only a 1.2% annual rate reflecting sharp downturns in industrial activity in 1975 and 1980-82. Linerboard production, however, has grown at a slightly faster 1.9% annual rate, reflecting stronger growth in export shipments. Exports grew at a 5.3% average annual rate

CURRENT LINERBOARD GRADE STRUCTURE

Basis weight (lb/1,000 ft^2)	Maximum burst test[1] (psi)	Grade distribution[2] (%)
26	65	5
33	80	11
38	90	7
42	100	50
47	—	—
69	135	21
90	160	4
other	—	2

1. PULP & PAPER, April 1979.
2. Fibre Box Assn., 1984.

MONTHLY CONTAINERBOARD INVENTORY AT U.S. BOX PLANTS AND MILLS

(000 short tons/weeks of supply*)

	1984		1983		1982		1981		1980	
Month	Tons	Weeks	Tons	Weeks	Tons	Weeks	Tons	Weeks	Tons	Weeks
Jan. 1	2,437	7.2	2,584	8.9	2,729	9.4	1,984	6.2	1,979	6.2
Feb. 1	2,404	6.1	2,485	7.1	2,482	7.5	1,960	5.5	1,991	5.3
Mar. 1	2,467	6.3	2,462	7.2	2,468	7.3	2,029	5.6	1,905	5.4
Apr. 1	2,448	6.2	2,414	6.8	2,570	7.4	2,104	5.7	1,890	5.4
May 1	2,512	6.2	2,495	6.9	2,656	7.6	2,232	5.9	2,021	5.7
June 1	2,541	6.5	2,463	6.8	2,671	8.1	2,298	6.7	2,119	6.5
July 1	2,659	7.1	2,511	6.8	2,650	7.9	2,368	6.7	2,248	7.0
Aug. 1	2,785	7.4	2,486	7.4	2,595	8.3	2,371	6.9	2,291	7.3
Sept. 1	—	—	2,421	6.6	2,553	7.5	2,376	6.9	2,225	7.1
Oct. 1	—	—	2,339	6.0	2,393	6.5	2,451	6.6	2,101	5.8
Nov. 1	—	—	2,302	5.8	2,424	6.9	2,437	7.1	1,880	5.6
Dec. 1	—	—	2,415	6.5	2,524	7.6	2,602	7.9	1,836	5.5

	1979		1978		1977		1976		1975		1974	
Month	Tons	Weeks	Tons	Weeks	Tons	Weeks	Tons	Weeks	Tons	Weeks	Tons	Weeks
Jan 1.	1,961	5.8	2,437	7.2	2,507	8.0	2,185	7.2	2,323	8.9	1,595	4.7
Feb. 1	1,825	5.1	2,297	7.0	2,376	7.8	2,136	7.0	2,156	8.5	1,541	4.6
Mar. 1	1,807	5.1	2,242	6.6	2,393	7.7	2,138	7.1	2,233	9.0	1,527	4.6
Apr. 1	1,789	5.0	2,208	6.1	2,412	7.5	2,172	7.0	2,264	9.0	1,558	4.7
May 1	1,846	4.8	2,179	6.4	2,463	7.4	2,316	7.4	2,306	9.1	1,623	5.0
June 1	1,856	5.2	2,155	6.0	2,513	7.5	2,393	7.5	2,296	8.6	1,732	5.4
July 1	1,863	5.3	2,169	6.1	2,577	8.0	2,506	8.2	2,244	8.1	1,810	5.8
Aug. 1	1,939	5.5	2,206	6.6	2,581	8.3	2,539	8.4	2,125	7.8	1,833	5.9
Sept. 1	1,945	5.6	2,119	6.0	2,613	8.0	2,604	8.5	2,079	7.0	1,907	6.3
Oct. 1	1,938	5.3	2,004	5.5	2,457	7.2	2,442	7.7	1,969	6.1	1,925	6.4
Nov. 1	1,877	4.8	1,923	5.1	2,439	7.1	2,456	7.6	1,964	6.4	1,965	6.7
Dec. 1	1,953	5.5	1.939	5.6	2,442	7.2	2,516	7.9	2,079	6.9	2,078	7.0

* Obtained by dividing inventories by average weekly usage in corrugated box plants during prior month, excluding holidays.
p = Preliminary.

Source: Fibre Box Assn. annual reports.

over the 1974-83 period, helped by strong growth in shipments to the Far East.

The U.S. corrugated box market is highly integrated, although independent converters with no linerboard or corrugating medium capacity of their own account for about 20% to 25% of U.S. corrugated box production. Linerboard produced by integrated companies is either supplied to their own converting operations at an internal transfer price, swapped with other producers to save on freight costs or sold in the open market. Only two companies, Great Southern Paper and Jacksonville Kraft Paper Co., have no converting plants of their own and sell all of their output to independent converters. Independent converters, therefore, are in the situation of having to buy board from the same companies they compete with in the corrugated box market.

The linerboard market is fairly fragmented with about 26 individual producers—although certain large net sellers such as International Paper and Great Southern have a major influence on industry pricing. Linerboard prices tend to be highly cyclical and usually rise during the middle and later stages of an economic recovery, but fall when demand weakens and producers have to fight for business to keep their capital-intensive mills running.

Linerboard pricing tends to be strongest when operating rates are around 95% or higher and inventories are below six weeks of supply. Normally, linerboard and corrugating medium prices tend to push up corrugated container prices. Containerboard accounts for about 55% of the cost of making a corrugated container.

Export linerboard normally sells at a premium to domestic linerboard near market peaks and at a discount during recessions. Europe is still the largest market for U.S. linerboard exports, but its share of total U.S. shipments declined from 52.4% in 1973 to 33.8% in 1983. Exports to the Far East and Oceania, however, increased over the same period from 9.6% to 29.6% in 1983. Exports to Latin America have been fairly stable, declining slightly fom 22.8% in 1973 to 17.1% in 1984.

Kraft linerboard accounted for only about 2.46 million tons (22.8%) of total western European containerboard consumption of 10.7 million metric tons in 1981. Test linerboard and corrugating medium (fluting) accounted for the remainder. Of total kraft linerboard requirements, 44% were supplied by Scandinavian producers and 28% by U.S. producers in 1983.

CURRENT MARKET CONDITIONS

U.S. corrugated box shipments stagnated along with industrial production during the last economic downturn, dropping from a peak of 261.1 billion ft^2 in 1979 to a low of 246.3 billion ft^2 in 1982. Linerboard production held up better the first years of the downturn, helped in 1980 by record linerboard export shipments of 2.2 million tons and in 1981 by some improvement in domestic box shipments and a heavy inventory buildup.

But production dropped sharply from a record 14.5 million tons in 1981 to a low of 13.5 million tons in 1982 during the second, more severe economic downturn. The drop in production, combined with an above-average rate of linerboard expansion during the 1981-82

RATIO OF U.S. CONSUMPTION OF PAPERBOARD TO CORRUGATED CONTAINER PRODUCTION

CORRUGATING MEDIUM TONNAGE FOR CONTAINERS

	Consumption by box plants (000 short tons)		Ratio
	Liner-board	Corrugating medium	(liner/ medium)
1983	12,594	5,768	2.18
1982	11,751	5,337	2.20
1981	12,262	5,530	2.22
1980	12,019	5,427	2.21
1979	12,456	5,654	2.20
1978	12,168	5,495	2.21
1977	11,318	5,103	2.22
1976	10,782	4,844	2.22
1975	9,609	4,320	2.22
1974	10,621	4,746	2.24
1973	11,315	5,060	2.24
1972	10,429	4,698	2.22
1971	9,465	4,273	2.22
1970	9,079	4,107	2.21

LINERBOARD TONNAGE FOR CONTAINERS

	Corrugator production (billion ft^2)	Linerboard consumed by box plants (000 tons)	Ratio (1,000 ft^2/ ton)
1983	264.2	12,594	20.980
1982	246.3	11,751	20.960
1981	253.0	12,262	20.633
1980	251.9	12,019	20.958
1979	261.1	12,456	20.962
1978	256.4	12,168	21.072
1977	238.8	11,318	21.099
1976	227.8	10,782	21.128
1975	203.2	9,609	21.147
1974	224.1	10,621	21.100
1973	238.5	11,315	21.078
1972	220.1	10,429	21.105
1971	200.3	9,465	21.162
1970	192.7	9,079	21.225
			Average: 21.044

Source: Based on data from Fibre Box Assn.

period due to the startup of several new machines, caused U.S. linerboard operating rates to plummet to 84% in 1982.

The weak operating rates, combined with heavy containerboard inventories at box plants and mills of around 2.5 million tons, caused linerboard prices to break in late 1981. The $300/ton eastern U.S. price for 42-lb kraft linerboard, which had been in effect since the beginning of 1981, dropped by $30/ton. Producers struggled to restore the old price in early 1982 but the price dropped again in the second half of the year, reaching a low of $250/ton, with some discounting below even that level. Poor pricing and low production levels resulted in substantial financial losses for most U.S. producers.

Linerboard production began to pick up with the economy in 1983 and reached a new record of 15.0 million tons. Domestic demand was helped by a 7.2% surge in corrugated box shipments to a record 264.2 billion ft², and by surprising strength in linerboard export shipments which jumped 15.1% to 2.09 million tons (based on Dept. of Commerce data). Linerboard mill operating rates for the year averaged 92.3% and producers were able to implement two $20/ton price increases, which brought the price of linerboard back to $290/ton.

This, however, was probably only a little bit better than breakeven for the average U.S. linerboard mill. Producers implemented another $30/ton increase to $320 in February of 1984 and attempted to push through another $30 increase to $350 in the fall.

However, the market began to show signs of softening in the second half of the year because of slower growth in domestic demand and weakness in export shipments. The strong dollar contributed to price weakness in export markets and made it more attractive to divert overseas volume to the domestic U.S. market. Incremental expansion projects undertaken at many mills in 1984 may also have contributed to high industry production levels. Although many mills began to take downtime, inventories continued to rise and price discounting became widespread as the year ended.

Great Southern Paper Co. in early January 1985

U.S. PRICES FOR EXPORT LINERBOARD +36-lb (+175 g) c.i.f. northern Europe

	$/short ton	$/metric ton
1984		
4th quarter	367/399	405/440
3rd quarter	367	405
2nd quarter	367	405
1st quarter	331	365
1983		
4th quarter	302*	333*
3rd quarter	302*	333*
2nd quarter	302*	333*
1st quarter	245/272*	270/300*
Year-end		
1982	272*	300*
1981	376	415
1980	345	380
1979	340	375
1978	254	280
1977	209	230*
1976	231	255
1975	281	310
1974	317	350
1973	222	245
1972	155	170
1971	125	137

* Some tonnage being sold below main transaction price levels.

Source: PULP & PAPER PRICEBOOK, 1984.

U.S. PRICES FOR UNBLEACHED KRAFT LINERBOARD

(42-lb, eastern U.S.)

	$ per short ton¹	$ per 1,000 ft²
1984		
4th quarter	350	7.35
3rd quarter	320/350	6.72/7.35
2nd quarter	320	6.72
1st quarter	290/320	6.09/6.72
1983		
4th quarter	290	6.09
3rd quarter	270/290	5.67/6.09
2nd quarter	270*	5.67
1st quarter	250*	5.25
Year-end		
1982	250*	5.25
1981	270*	5.67
1980	270	5.67
1979	250	5.25
1978	220	4.62
1977	185*	3.89
1976	205*	4.31
1975	195	4.10
1974	195	4.10
1973	145	3.05
1972	130	2.73
1971	127.50	2.68
1970	127.50	2.68

* Indicates some discounting from transaction levels.

1. List prices on West Coast have generally been higher—currently $10/ton above eastern price.

Source: PULP & PAPER PRICEBOOK, 1984.

reduced its list price on linerboard by $30/ton to $320 (and doubled the size of its zoned discounts for the Southeast and Midwest, bringing its effective delivered price in these regions to $300 and $310, respectively). While the action probably reflected market realities, the move was controversial because it threatened to undermine about a 7% box price increase pushed through in the second half of 1984.

Even though the year ended on a negative note, linerboard production in 1984 rose almost 7% to more than 16 million tons and the industry ran at about 97% of capacity. The outlook for 1985 is considerably more uncertain, given the possibility of sluggish economic growth and continuing strength of the dollar. Box shipments in 1985 are forecast to rise about 2.7% based on close to 3% real GNP growth. Linerboard production, however, is projected to rise only 1.1% because of a further 2.5% decline in export shipments due to the strong dollar, and an estimated 150,000 tons of inventory liquidation from the high levels that prevailed at the beginning of 1985 (2.8 million tons or 8.4 weeks of supply for both liner and medium).

Operating rates are projected to decline slightly but would still be about 97% of capacity. This level of activity should give producers a chance to restore the $350 list with the seasonal spring pickup in demand, although the large differential with export prices may contribute to further softness in the market. The unexpected weakness in pricing was a major disappointment to linerboard producers, which had earlier hoped for a strong improvement in profits after the poor results experienced in 1982-83.

FACTORS FOR CONVERTING PRICES FROM \$/TON TO \$/1,000 FT^2, AND FROM \$/1,000 FT^2 TO \$/TON

Basis weight (lb/1,000 ft^2)	FACTOR 1 \$/1,000 ft^2 to \$/ton	FACTOR 2 \$/ton to \$/1,000 ft^2
26*	76.92	0.01300
31*	64.52	0.01550
33*	60.61	0.01650
36*	55.56	0.01800
38	52.63	0.01900
42	47.62	0.02100
47	42.55	0.02350
69	28.98	0.03451
90	22.22	0.04500

To convert the price per 1,000 ft^2 to equivalent price on a per ton basis, multiply the price by FACTOR 1. For example, if the price of 33-lb linerboard is \$4.79/1,000 ft^2, multiply \$4,79 by 60.61. The price per ton is \$290.

To convert the price per ton to equivalent price per 1,000 ft^2, multiply price by FACTOR 2.

* Corrugating medium weights. Linerboard is normally produced at 26, 33, 38, 42, 47, 69 and 90 lb/1,000 ft^2.

INTERNATIONAL MARKETS

U.S. linerboard exports hit a peak of 2.53 million short tons in 1980, helped by strong purchases by the People's Rep. of China, according to Dept. of Commerce data. Exports then began to decline due to the growing world recession and strong U.S. dollar, hitting a low of 1.89 million tons in 1982. Export shipments rebounded to 2.25 million tons in 1983, 19.3% above their 1982 level, but in 1984 probably declined by about 8% due to the strong dollar, which has made U.S. exports less competitive. The strength of the dollar also kept export prices below equivalent domestic price levels through the end of 1984.

Prices for U.S. liner exports to northern Europe dropped sharply during the last recession, falling from a peak of $440/metric ton c.i.f. for heavyweight board in mid-1981 to below $300/ton in some markets in first quarter 1983. In response to anti-dumping complaints from Continental producers, the European Economic Community imposed a minimum price of $333/ton on U.S. heavyweight linerboard in March 1983.

U.S. shipments to western Europe began to rebound in 1983, rising 18% to 761,000 short tons from their level of the previous year. Two price increases in January and April brought the U.S. price for heavyweight linerboard to $405/metric ton in northern Europe. An attempt to push through a further $35/ton increase to $440 in the fourth quarter of 1984, however, was rescinded due to the strong U.S. dollar and inventory reduction by European converters.

The strong dollar has had the effect of dramatically increasing the cost competitiveness of Scandinavian kraft liner producers and Continental test liner mills. Test (recycled) linerboard has been selling at levels 30% or more below the price of imported U.S. kraft linerboard. There has also been increasing competition in the European market from nontraditional supplying countries, such as Portugal, Spain, Brazil and South Africa. U.S. export shipments to Europe in 1984 declined about 13% to 660,000 tons from the year earlier.

Prices in the European market deteriorated further in early 1985 on weak volume as customers held off on orders in expectation of even lower prices. Scandinavian producers increased their sales in local European currencies at list prices which, translated into dollars, were roughly in the $360 to $380/metric ton c.i.f. range. But discounting of 5% or more was reportedly taking place from these levels and there was concern that prices could slide back down to the 1983 antidumping level before stabilizing.

Unless the dollar weakens significantly, U.S. linerboard exports to western Europe will probably show little growth over the next several years. According to a forecast made by Bengt Hamrefors, general manager and CEO of ASSI Kraftliner of Sweden, the share held by kraft liner of total European corrugated material production will decline from 28% in 1981 to 26.5% in 1984 and drop to 26% by 1985-86 (see table).

Because of their strong currency advantage, Swedish and Continental kraft liner producers will increase their share of the available kraft liner market. As a result, western Europe's import requirements will decline from 950,000 metric tons in 1983 to 690,000 tons in 1986, he told *Pulp & Paper*'s First International Unbleached Kraft Conference held in the fall of 1984. These import requirements must be shared by U.S. producers with competitors from Canada, U.S.S.R., Brazil and South Africa. Brazil exported about 100,000 tpy of kraft liner to all world markets in 1983 and its shipments were expected to show another jump in 1984. Total exports from South Africa, where two major expansions were recently completed, are projected to rise to 280,000 tpy by 1986 compared with only about 75,000 tpy in 1984.

No major new linerboard capacity has been announced for Scandinavia and western Europe, however. Scandinavian companies have been emphasizing bleached kraft and mechanical paper grades to better utilize limited fiber resources through production of higher-yield and more-value-added grades. Major Scandinavian kraft linerboard producers and their estimated capacities include: Svenska Cellulosa AB (Munksund and Obbola, Sweden), 610,000 metric tpy; ASSI (Pitea and Lövholmen, Sweden), 470,000 tpy; and Kemi Oy of Finland, 240,000 tpy. Major Continental kraft liner producers include Cellulose du Pin of France, 310,000 tpy; Portucel of Portugal, 175,000 tpy; and Nettingsdorfer Papierfabrik AG of Austria, 115,000 tpy.

The Far East (with the exception of Japan) has served as something of a dumping ground for excess linerboard supplies, and prices plummeted sharply during the last recession. Lightweight linerboard (125-g) in such markets as Hong Kong, Singapore and Malaysia dropped from a prerecession peak of around $460/metric ton to below $300/ton in early 1983 due to growing spot sales at distress prices.

U.S. liner shipments to the Far East and Oceania (excluding Japan) surged 31.6% to 478,000 short tons in 1983, helped by inventory building, and remained relatively unchanged in 1984. U.S. producers began to ratchet up export prices to the region, with the list price of lightweight liner reaching about $430 to $450/metric ton in such markets as Hong Kong and Singapore by May of 1984. Actual selling prices in the region, however, began to weaken in the fall of 1984 as some U.S. producers began to dump board to reduce excess linerboard inventories. And by early 1985 prices for lightweight board had reached about $350/metric ton and even lower.

The wild card in the U.S. linerboard export equation has been People's Rep. of China, which made its first major purchases of U.S. liner in 1980 totaling 319,000 tons. Exports then declined sharply to 111,000 tons in 1982 as the Chinese worked down their huge inventories. Chinese buying then picked up in 1983 and totaled 166,000 tons before dropping off to 125,000 tons in 1984. The Chinese have proven to be shrewd low price buyers and their heavy purchases in 1983 averaged only $209/metric ton on an f.a.s. basis, based on Dept. of Commerce data. U.S. producers, however, were successful in ratcheting up prices about $100/ton during the first half of 1984.

The Chinese will probably step up linerboard purchases in 1985 as export prices bottom out. Although erratic, U.S. linerboard exports to China will probably

DELIVERIES OF UNBLEACHED KRAFT LINERBOARD TO WESTERN EUROPE, 1981–84*

(000 metric tons)

	1984	1983	1982	1981
Scandinavia	1,230	1,170	1,150	1,080
Continental Europe	730	660	630	610
U.S.	650	700	600	610
Canada	120	140	110	130
U.S.S.R.	50	50	50	90
Brazil	80	60	20	20
Total	2,860	2,780	2,560	2,540

*Includes mottled white board.
e = Estimate.

Source: ASSI Kraftliner.

U.S. EXPORT AND IMPORT OF LINERBOARD GRADES

(000 short tons)

	Exports		
	Unbleached	Bleached	Imports[1]
1983	2,094	180	48
1982	1,819	68	36
1981	1,822	152	48
1980	2,293	234	43
1979	1,465	180	26
1978	1,345	194	32
1977	1,297	130	14
1976	1,288	131	4
1975	1,075	149	—[2]
1974	1,609	133	10
1973	1,576	70	6
1972	1,727	150	1
1971	1,966	—	10
1970	1,761	—	—[2]

1. Includes test of containerboards with burst test of over 60 lb.
2. Imports less than 500 tons.

Source: U.S. Dept. of Commerce.

LINERBOARD EXPORTS FROM MAJOR PRODUCING COUNTRIES IN 1983

(000 metric tons)

Importer			Exporter		
EUROPE	USA	Canada	Sweden	Finland	Norway
Austria	2	-	16	1	-
Belgium	11	77	30	12	-
Denmark	-	-	64	11	-
France	25	-	158	23	-
Germany, Fed. Rep.	119	-	172	39	2
Greece	20	-	12	-	-
Ireland	8	-	25	2	-
Italy	119	-	49	1	-
Netherlands	36	1	82	23	1
Norway	1	-	29	5	-
Spain	10	-	-	5	-
Switzerland	31	-	22	2	-
United Kingdom	293	63	220	50	5
USSR	-	-	-	43	-
Other	3	8	17	11	-
Total Europe	**678**	**149**	**896**	**228**	**8**
NORTH AMERICA					
Canada	43	-	-	-	-
United States	-	45	-	-	-
Total North America	**43**	**45**	**-**	**-**	**-**
ASIA/AUSTRALASIA					
China	151	9	23	0	-
Hong Kong	10	2	-	-	-
Iran	-	11	14	5	-
Israel	72	-	7	2	-
Japan	172	43	-	-	-
Korea, Rep. of	19	1	-	-	-
Malaysia	28	1	-	-	-
Philippines	51	-	-	-	-
Singapore	43	6	1	1	1
Taiwan	12	-	-	0	-
Other	127	16	17	1	1
Total Asia/Australasia	**685**	**87**	**62**	**9**	**2**
LATIN AMERICA					
Colombia	59	-	-	-	-
Costa Rica	64	-	-	-	-
Ecuador	31	-	-	-	-
Guatemala	27	-	-	-	-
Mexico	18	-	-	-	-
Panama	59	-	-	-	-
Other	144	9	-	0	-
Total Latin America	**402**	**9**	**-**	**0**	**-**
AFRICA					
Egypt	33	-	2	0	-
Ivory Coast	22	-	-	1	-
Morocco	2	-	19	1	-
Nigeria	24	-	2	0	-
South Africa	17	-	-	1	-
Other	55	1	17	0	-
Total Africa	**153**	**1**	**40**	**3**	**-**
WORLD TOTAL	**2,044**	**281**	**998**	**240**	**11**

Source: PULP & PAPER INTERNATIONAL, Annual Review, August 1984.

show long-run growth. China has only limited forest resources, but will need more linerboard to package its growing light manufactured goods exports to the West.

U.S. exports to Japan jumped 61% to 189,000 tons in 1983 and rose another 6% to around 200,000 tons in 1984. Prices in the Japanese market tend to be more stable because of special-quality requirements and long-term business relationships that make it difficult for spot sellers to enter the market. Weyerhaeuser Co., the largest liner exporter to Japan, has set up a warehouse system in Japan and has begun selling liner in yen to Japanese customers. Other regular suppliers to Japan include Eurocan Pulp & Paper Co. Ltd.'s Kitimat, B.C., mill and Champion International Corp.'s Tacoma, Wash., mill.

The Japanese containerboard industry has been suf-

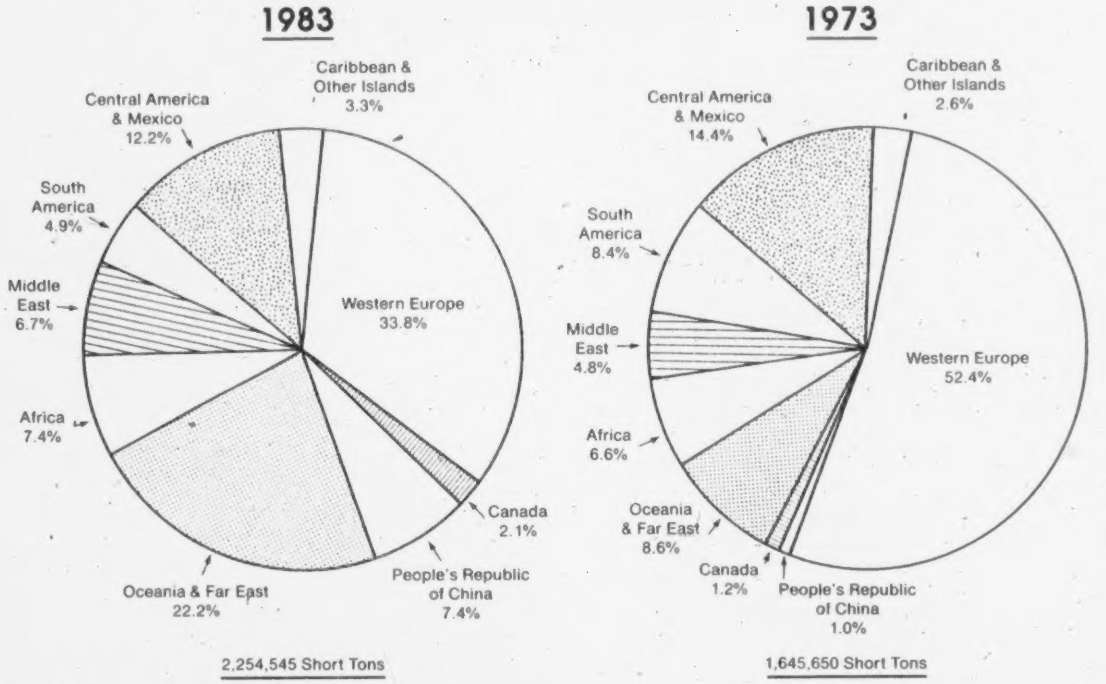
JAPANESE LINERBOARD MARKET SUPPLY/DEMAND TRENDS, 1982–85

(000 metric tons)

	1985e	1984e	1983	1982
Domestic consumption	4,282	3,964	3,602	3,348
Less imports	297	263	240	203
	3,985	3,701	3,362	3,145
Plus exports	95	99	92	69
Total domestic production	4,080	3,800	3,454	3,214
Capacity	4,638	5,208	5,208	4,943
Operating rate, %	88	73	66	65

Source: Weyerhaeuser Co.

PERCENTAGE DISTRIBUTION OF U.S. LINERBOARD EXPORTS BY AREA OF DESTINATION



1983

2,254,545 Short Tons

1973

1,645,650 Short Tons

Source: American Paper Institute from Dept. of Commerce.

fering from overcapacity and high production costs and the government has given approval to a program to reduce capacity by 20% by 1987. A substantial portion of future Japanese consumption growth is expected to be met by imports. The Ministry of International Trade and Industry (MITI) has projected that containerboard imports from all sources may rise from 176,000 tons in 1979 to 560,000 tons by 1990. Under pressure from the U.S. government, Japan has also accelerated its scheduled tariff reductions on imported linerboard.

U.S. exports to Latin America in 1983 and 1984 remained relatively flat at around 400,000 tons. The lack of growth reflected the heavy debt burden of many countries in the region and efforts to reduce imports. U.S. export prices to Latin America tend to be more stable because of long-term contracts with major customers, such as banana and coffee growers, which export to the U.S.

Thus, the Far East will continue to account for an increasing share of U.S. linerboard exports, while Europe will account for a shrinking share and Latin America and other parts of the world will remain relatively stable. In 1985, the Pacific Rim countries (including Japan and Australia) could account for 35% of U.S. linerboard exports compared to 30% for Western Europe.

FUTURE OUTLOOK

The longer-run outlook for the U.S. linerboard market is fairly bright because of limited capacity growth. The major uncertainty on the demand side is the strong

UNBLEACHED KRAFT LINERBOARD SUPPLY/DEMAND FOR WESTERN EUROPE, 1982–86*

(000 metric tons)

	1986e	1985e	1984e	1983	1982	1981
Corrugated board production	10,610	10,830	10,410	10,010	9,740	9,740
Kraftliner share	26.0%	26.0%	26.5%	27.0%	27.0%	28.0%
Kraftliner consumption	2,760	2,820	2,760	2,700	2,630	2,730
Inventory change (estimate)	−50	−100	+50	+80	−70	−190
Kraftliner apparent consumption	2,710	2,720	2,810	2,780	2,560	2,540
Kraftliner domestic supply	2,020	1,990	1,960	1,830	1,780	1,700
Import requirements to western Europe	690	730	850	950	780	840

*Includes mottled white board.
e = Estimate.

Source: ASSI Kraftliner.

U.S. EXPORTS OF KRAFT LINERBOARD BY AREA OF DESTINATION*

(000 short tons)

	1983	1982	1980	1973
Canada	48	48	26	19
Western Europe	761	644	919	862
Central America/Mexico	276	264	337	237
Caribbean/Other islands	74	54	46	43
South America	110	133	130	138
Middle East	151	112	99	79
Africa	108	149	241	108
Oceania/Far East	501	372	411	141
China, People's Rep.	166	111	319	17
TOTAL	2,255	1,886	2,527	1,645

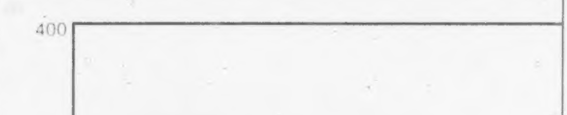
* Includes bleached linerboard.

Source: American Paper Institute from Dept. of Commerce.

dollar, which has been holding back growth in U.S. linerboard export shipments. Some analysts had earlier expected linerboard export shipments to grow at a pace about twice the rate of domestic demand rather than to lag it, as was the case in 1984. The large U.S. trade gap also indirectly reduces domestic linerboard demand since the large influx of imported merchandise is packaged in boxes made overseas. Shrink and stretch plastic film could also capture some U.S. market share from corrugated boxes, but so far the inroads by plastic film used to wrap unitized loads has not been too significant.

The supply side of the linerboard market equation is somewhat more certain since it takes three or four years to complete a major linerboard expansion. The 1984 API survey showed U.S. linerboard capacity rising at a 1.1% average annual rate over the 1985-87 period, from 16.5 million tons in 1984 to 17.1 million tons in 1987 or a rise of 564,000 tons. The only new machine included in these numbers is a 315,000-tpy machine being installed by Chesapeake Corp. at its West Point, Va., mill for startup in late 1985. However, the net increase from the expansion will be only slightly more than half that amount, due to the planned conversion in early 1986 of an existing liner machine at the mill to recycled medium production.

COST COMPARISON FOR KRAFT LINERBOARD PRODUCTION IN U.S. SOUTH AND SWEDEN—THIRD QUARTER OF 1984



* Delivered to northern European port but excluding interest charges and sales commission.

Source: Andover International Associates.

Even if capacity growth is slightly higher than the 1.1% growth projected in the 1985-87 survey period, the rate would still be less than half the 3.3% average annual growth of the past 15 years. The slowing rate of capacity expansion reflects the industry's depressed pricing and poor profitability in recent years. Company executives and analysts have estimated that a linerboard price of anywhere from $450 to $500 is required to justify the investment in a major new greenfield linerboard mill.

New greenfield linerboard mills earlier proposed by Champion International and Georgia Kraft Co. are believed to have been postponed indefinitely. And new machines previously under study by Owens-Illinois and Georgia-Pacific Corp. have also been postponed or cancelled. A new linerboard mill earlier proposed by another new company, Augusta Kraft Corp., for Tuscaloosa, Ala., also faces uncertain financing.

Companies which have made strategic decisions to expand in the unbleached kraft industry have found it cheaper to buy new capacity than to invest in new machines or mills. Stone Container Corp., for example, purchased three unbleached kraft mills and 20 converting plants from Continental Group Inc. for $510 million in late 1983. The mills were purchased for around $120,000 per daily ton, excluding working capital and without assigning any value to the converting plants included in the deal, Roger W. Stone, chairman and CEO, said in a *Pulp & Paper* interview. The average cost per ton represented about one-third that of building new capacity.

In 1984 Georgia-Pacific Corp. acquired St. Regis Corp.'s 1,680-tpd Monticello, Miss., linerboard and kraft paper mill, 16 corrugated box plants and related timberlands for $343 million. Champion International, which in late 1984 acquired the remainder of St. Regis, may be forced to spin off that company's remaining Tacoma, Wash., linerboard mill. Such acquisitions, of course, add nothing to overall industry production capacity and consume the capital resources of expansion-minded companies.

Besides low return on investment, several other factors have been holding back investment in new linerboard mills and machines. Factors which may make capacity more resilent than expected include:

(1) the permanent shift of machines to linerboard from production of kraft paper, which has been under heavy competition from plastic film;

(2) the rate of incremental capacity growth from new high-pressure loaded presses, such as the Extended Nip and other small technological improvements, permitting debottlenecking of pulp mills and improvement of recovery cycle performance;

(3) possible future impact of revised Rule 41 transportation standards, which could eventually permit use of lower basis weight linerboard in corrugated boxes;

(4) rapid expansion of recycled linerboard capacity from a small base.

As noted earlier, U.S. recycled linerboard capacity will jump nearly 50% to 590,000 tpy by 1987, with completion of Temple-Inland Inc.'s new Ontario, Calif., mill and International Paper's reactivation of the Durham mill in Riegelsville, Pa. Willamette Industries Inc. has also indicated plans to emphasize production of liner at its recycled Port Hueneme, Calif., recycled containerboard mill.

Kraft paper swing capacity. Unbleached kraft paper has been under competitive pressure from plastic film for a number of years and capacity over the 1983-87 period is expected to decline by 360,000 tons to 3.7 million tons in 1987, according to the 1984 American Paper Institute capacity survey. Part of this projected decline is due to the swing of kraft paper machines to the production to kraft linerboard. Such conversions may increase a machine's capacity by 15% to 20% or more since the linerboard to be produced will usually have a heavier basis weight.

The most important unbleached kraft paper market now under siege from plastic film is grocery sacks. Some consultants expect plastic sacks to capture as much as 20% to 25% of the approximately 2.2-million-ton grocery bag and sack market by 1986 (see section on Packaging and Industrial Converting Papers). Estimated 1983 plastic penetration of the grocery sack market in 1983 was only about 5%—less than had been predicted earlier. One reason could be higher supermarket labor costs for bagging, according to a recent study commissioned by API.

As a result of the perceived threat from plastic and poor profitability, a number of producers have announced plans to convert unbleached kraft paper capacity to other grades beyond what is reflected in the 1983 API capacity survey. Georgia-Pacific and International Paper have announced plans to convert about 450,000 tpy of kraft paper to other grades over the 1984-86 period. IP also said it may close its 255,000-tpy Camden, Ark., kraft paper mill at a later date. In addition, Haindl Papier has indicated possible plans to someday convert its 160,000-tpy Port Townsend, Wash., unbleached kraft mill to bleached grades.

However, most of these projects involve conversion of machines to white paper production. The one exception is G-P's plan to convert the kraft paper machine at its recently acquired Monticello, Miss., mill to linerboard in late 1985 or 1986. Elimination of all of this capacity should keep operating rates for unbleached kraft paper in the high 90% range over the next several years, even though production may show a slight decline, according to most analysts. And this should limit the amount of kraft paper capacity swung into linerboard production over the next several years. (See Kraft Paper section.)

New press section technology. Incremental linerboard capacity has probably been growing at a faster-than-projected rate. This is due to a major effort over the last several years to eliminate production bottlenecks and gain incremental capacity on existing machines. High-pressure loaded presses, such as Beloit Corp.'s Extended Nip Press, are one example of this development.

The ENP increases nip pressure in the press section by passing a sheet between a single-grooved press roll opposed by a stationary loaded shoe. Pressure equivalent to 6,000 pli can be achieved because of the longer

ESTIMATED UNBLEACHED KRAFT LINERBOARD CAPACITIES OF U.S. COMPANIES

	Annual capacity (000 tons)	Capacity share (%)
1. International Paper	1,580	9.5%
2. Weyerhaeuser	1,370	8.2
3. Stone Container	1,345	8.1
4. Union Camp	1.340	8.0
5. Champion International	1,037[1,3]	6.2
6. Container Corp. of America (Mobil)	873	5.2
7. Owens-Illinois	720	4.3
8. Great Southern Paper (Great Northern Nekoosa)	710	4.3
9. Georgia-Pacific	700	4.2
10. Westvaco	660	4.0
11. Packaging Corp. of America	607	3.6
12. Temple-Inland	778[2]	4.7
13. Willamette Industries	540	3.2
14. St. Joe Paper	458	2.7
15. MacMillan Bloedel	445[3]	2.7
16. Southwest Forest Industries	420	2.5
17. Mead	400[2]	2.4
18. Jacksonville Kraft	388	2.3
19. Arkansas Kraft (Green Bay Packaging)	379	2.3
20. Boise Cascade	370	2.2
21. Longview Fibre	332	2.0
22. Crown Zellerbach	330	2.0
23. Jefferson Smurfit	300	1.8
24. Chesapeake	270	1.6
25. Louisiana-Pacific	270	1.6
26. Interstate Resources	195	1.2

Total U.S. capacity (1985): 16.670 million tons
Capacity share of top 5 companies: 40.1%
Capacity share of top 10 companies: 62.0%

1. Includes St. Regis Corp.'s Tacoma, Wash., mill (171,000 tpy) which must be run separately and may have to be divested under an agreement between Champion and the Federal Trade Commission.
2. Includes Georgia Kraft Co., which is owned jointly by Temple-Inland and Mead. Clay-coated kraft board output from the venture's Phenix City, Ala., mill (353,000 tpy) has been assigned to Mead. The coated board is mainly used to make beverage carriers.
3. Reflects U.S. operations only.

dwell time of the sheet in the double-felted ENP—five to eight times that obtainable with roll presses. The increased pressure can reduce steam requirements per ton in the dryer section by as much as 20% and permit an increase in incremental capacity of 15% or more, according to Beloit. The ENP also increases sheet strength or permits papermakers to use more secondary or hardwood fiber at the same strength level.

As of mid-1984, 14 ENPs had been installed or were on order, of which about half were in North America. All but one of these was for linerboard production. Among the first companies to make installations were Weyerhaeuser, two at its Springfield, Ore., mill and one at Plymouth, N.C., and Container Corp. of America at Brewton, Ala.

Several European paper machinery manufacturers have also come out with more conventional high-pressure presses that utilize double felting and soft roll covers. Such presses can typically operate at 1,200 to 1,600 pli and loadings as high as 2,500 pli are reported to be feasible. Operating problems, mainly connected to short felt life, are gradually being overcome and use of high-pressure presses is expected to grow.

Possible changes in basis weight. Most containerboard producers are supporting a proposed alternative to Rule 41 rail and Item 222 truck specifications. These specifications require that boxes meet certain basis weight and bursting strength criteria (see chapter on Converted Products).

The proposed alternative would permit a 20% reduction in bursting strength for boxes, establish standards for compression strength as measured by an edge crush value and would add a new grade of single-wall and a new grade of double-wall board (which would permit some limited use of lighter-weight liner facings). It proposes some small changes in a few dimensions and in the gross weight limits. There would be no change in the weight of facings. The alternative rules would permit containerboard manufacturers to use more hardwood fiber and to change their operations to produce board with better stiffness.

The Uniform Classification Committee of the railroads in 1984 said it was prepared to issue test permits and the National Motor Carriers Freight Classification Board has already issued a blanket permit. Boxmakers and their customers will make trial shipments over the next several years using boxes made according to the new specifications.

Proponents would like to eventually eliminate basis weight requirements and relate all specifications to performance requirements. If this happened, the average basis weight of linerboard used to make corrugated boxes would probably decline. If surface area requirements for corrugated boxes remain the same, linerboard production in tons could decline 4% or 5% (500,000 to 600,000 tons), according to some forecasters. This loss in tonnage, however, would be at least partly offset by higher upcharges on lighter-weight linerboard.

More than likely, however, industry linerboard tonnage would not show much of a decline since some dryer-limited machines could be speeded up running lighter-weight board. Thus, the number of tons produced by existing machines would not fall by much, but output on a surface area basis would rise. Some industry observers also argue that basis weights for corrugated containers may not go down that much on average because of the increasing shift to plastic from metal and glass in primary packaging—necessitating, in turn, heavier corrugated boxes with more compression strength.

CORRUGATING MEDIUM

Corrugating medium is used to form the central or middle fluting material in corrugated containerboard. It is first fluted or corrugated in a corrugator, then faced on both sides with linerboard to form the rigid combined board.

Corrugating medium includes paperboard made from both semichemical pulp and recycled fiber. In 1983, 78% of all U.S. corrugating medium was made from a semichemical pulp furnish, while 22%, called "bogus" medium, was produced from recycled fiber. Basis weights of corrugating medium are 22, 26, 31, 33 and 36 lb/1,000 ft^2.

Semichemical corrugating medium is made primarily from hardwoods, but some western mills use softwood species. Softwood sawdust is also used. Nearly all types of hardwood species are used, but some semichemical mills find it difficult to pulp certain species, such as white oak. Semichemical medium is normally manufactured on conventional fourdrinier paper machines, but a small percentage is produced on cylinder board machines and one mill in Wisconsin uses a twin-wire machine.

Semichemical medium contains some long fiber to improve paper machine runability and also to lessen the tendency of the medium to crack and break upon corrugating. The principal sources of long fiber are waste corrugated containers and new double-lined kraft cuttings. The amount of secondary fiber used varies from none to 50%, but average wastepaper content is close to 20%. In some cases, screenings from kraft mills or kraft softwood pulp is used as the source of long fiber.

Semichemical pulping combines a mild chemical pulping of chips prior to mechanical defibrating and produces a fairly high yield, 60% to 80%, and an intermediate strength level. Neutral sulfite semichemical (NSSC), developed in the 1920s, was the original semichemical pulping process. Chemicals used include sodium sulfite and soda ash and pulping was initially performed using rotary batch digesters. Most semichemical mills now use continuous digesters and there has been a shift from NSSC to the newer carbonate base and green liquor semichemical pulping processes.

More than 60% of U.S. semichemical mills have now shifted from NSSC to the O-I nonsulfur and green liquor processes. These processes, developed since the 1960s, are simpler, less capital intensive and have fewer pollution problems. The O-I process uses soda ash (sodium carbonate) and a small amount of caustic soda and is adaptable to existing stand-alone semichemical mills with only minor equipment modifications.

Green liquor semichemical pulping uses kraft green

U.S. STATISTICS FOR CORRUGATING MEDIUM

	1985e	1984	1983
Production			
Semichemical	5,225	5,162	4,731
Recycled	1,344	1,320e	1,302
Total	6,569	6,482	6,003
Capacity, 000 tons			
Semichemical	5,299	5,219	5,156
Recycled	1,493	1,482	1,427
Total	6,792	6,701	6,583
Utilization rates, %			
Semichemical	98.6	98.9	91.8
Recycled	90.0	89.1	91.2
Imports[1]	115	100	75
Exports[1]	50	40	75
Apparent U.S. consumption			
000 tons	6,634	6,505	6,048
lb/capita	55.40	54.22	50.94
000 tons/$ billion real GNP	3.94	3.93	3.85

e = Estimate.

1, Dept. of Commerce.

liquor and therefore the process can be used only in combination with a kraft mill. Such cross-recovery reduces chemical processing and recovery and minimizes capital costs. Both the O-I and green liquor processes produce a semichemical pulp comparable in quality to NSSC, except for a darker color. Wetting agents, however, must be added to the refined stock to control glue absorption in the finished board.

Mills producing corrugating medium from 100% wastepaper (bogus medium) use primarily old corrugated containers as a source of fiber. Because waste corrugated containers contain foreign materials (tape, hot melts, latexes, asphalt, waxes, etc.) mills use cleaning equipment on the stock to remove contaminants. To improve the strength of bogus medium, a number of additives are used—typically, modified starches and gums. At 5- to 10-lb/ton, these additives can improve concora (strength) by 10% to 20%.

The principal test used to judge the strength of corrugating medium is the concora test. Concora is normally controlled by refining and by choice of fiber types. Typical concora values for standard basis weights are 60 to 70 lb for 26-lb medium and 80 to 100 lb for 33-lb medium.

ESTIMATED CORRUGATING MEDIUM CAPACITIES FOR U.S. PRODUCERS

Annual capacity (000 tons)

	Semi-chemical medium	Recycled medium	Total	Capacity share (%)
1. Weyerhaeuser	609	—	609	9.0%
2. Owens-Illinois	600	—	600	8.8
3. Stone Container	414	85	499	7.3
4. Inland Container	186	246	432	6.4
5. Champion International	186	200[1]	406	6.0
6. Willamette Industries	230	120	332	4.9
7. Mead	330	—	330	4.9
8. Container Corp. of America	115	160	275	4.0
9. Packaging Corp. of America	254	—	254	3.7
10. International Paper	250	—	250	3.7
11. Virginia Fibre	215	—	215	3.2
12. MacMillan Bloedel	210	—	210	3.1
13. Jefferson Smurfit	—	210	210	3.1
14. Georgia-Pacific	185[2]	—	185	2.7
15. Great Northern Nekoosa	176	—	176	2.6
16. Weston Paper	135	—	135	2.0
17. Menasha	130	—	130	1.9
18. Green Bay Packaging	125	—	125	1.8
19. Westvaco	110	—	110	1.6
20. Groveton Paper	106	—	106	1.6
21. Manville Forest Products	106	—	106	1.6
22. Boise Cascade	100	—	100	1.5
23. James River	91	—	91	1.3
24. Sonoco Products	65[2]	—	90	1.3
25. Harriman Paperboard	88	—	88	1.3
26. Crown Zellerbach	—	82	82	1.2
27. Dixie Container	—	77	77	1.1
28. Longview Fibre	70	—	70	1.0
29. Consolidated Packaging	65	—	65	1.0

U.S. capacity (1984): 6,800 million tons

Capacity share of top five companies: 37.4%

Capacity share of top ten companies 58.6%

Other producers that make small quantities of recycled medium include Neward Boxboard, Connelly Containers, Menominee Paper, Greif Board, Kieffer Paper Mills, Specialty Paper Mills, Corrugated Services, and Warrensburg Board and Paper.

1. Includes St. Regis mill at York, Pa., which produces some recycled medium.

2. Includes a 50% interest in a 130,000-tpy semichemical medium machine at Sonoco Products' Hartsville, S.C., mill. Georgia-Pacific takes all of its output.

The bulk of corrugating medium (82%) is produced at 26 lb/1,000 ft. Other grades produced are 22, 31, and 36 lb. There has been a trend toward heavier weight medium, with some interest in basis weights above 36 lb and as high as 52 lb. This will probably accelerate if Rule 41 transportation standards are altered, placing greater emphasis on top-to-bottom compression strength in corrugated boxes and permitting use of lower weight linerboard facings.

Wet-strength grades are also made, mainly in 33- and 36-lb weights and a 40-lb board is also available. Corrugating medium for conventional use is not sized. Hard sizing would interfere with starch gluing and result in poor adhesion between liner and medium.

Semichemical pulp and paper mills (about 42 mills) are located throughout the U.S., but installations in Canada are limited to mills in the eastern and Maritime provinces. Recycled medium mills are usually located in major urban areas, near wastepaper supplies and major box markets, giving them an advantage in transportation costs.

PRODUCTION/CAPACITY TRENDS

Production of corrugating medium generally follows that of linerboard, with about one ton of medium currently used for every 2.18 tons of liner in producing corrugated containers (see Linerboard section).

In 1983, production of corrugating medium jumped by 8.8% to 6.03 million tons, reflecting a 7.4% rise in U.S. corrugated box shipments. Semichemical medium production increased 7.8% to 4.73 million tons, while recycled medium jumped 12.6% to 1.3 million tons. With almost flat capacity growth in 1983, operating rates for semichemical medium snapped back to 91.8% from 84.3% in 1982, while recycled medium mills ran at 83.7%.

Part of the reason for the sharp drop in operating rates during the 1982 recession is reflected in the startup of new semichemical medium machines by International Paper Co. at Mansfield, La. (210,000 tpy), in late 1981 and by MacMillan Bloedel Inc. at Pine Hill, Ala. (210,000 tpy), in 1983. This was partly offset by the shutdown of IP's 210,000-tpy Bastrop, La., mill and the conversion of a semichemical medium machine to linerboard at Container Corp. of America's Fernandina Beach, Fla., mill in 1983.

Availability of semichemical medium became tight toward the end of 1983, with some integrated companies desperately searching for supplies. Incremental expansion projects at existing mills and the startup of several machines idled during the recession helped to ease the tightness and by summer 1984 corrugating medium was in excess supply.

In late 1983 Packaging Corp. of America reactivated an 80,000-tpy semichemical medium machine shut down in mid-1982 at its Filer City, Mich., mill, and Manville Forest Products Corp. restarted a 105,000-tpy

ANNUAL U.S. CAPACITY FOR CORRUGATING MEDIUM

(000 short tons)

	Semi-chemical	Recycled	Total	% change
1986e	5,253	1,585	6,838	0.2%
1985e	5,240	1,583	6,823	0.3
1984e	5,218	1,582	6,800	1.3
1983	5,156	1,555	6,711	0.4
1982	5,207	1,478	6,685	5.5
1981	4,988	1,349	6,337	1.0
1980	4,946	1,330	6,276	0.3
1979	4,864	1,392	6,256	2.8
1978	4,739	1,343	6,082	1.4
1977	4,661	1,337	5,998	−3.8
1976	4,758	1,476	6,234	4.2
1975	4,536	1,449	5,985	3.5
1974	4,430	1,358	5,788	4.0
1973	4,386	1,178	5,564	6.6
1972	4,155	1,063	5,218	5.6
1971	3,938	1,000	4,938	2.2
1970	3,847	983	4,830	—

e = Estimate

Source: American Paper Institute

semichemical medium machine in mid-1984 which had been shut down about the same time. Meanwhile, Jackson Paper Manufacturing Co., a subsidiary of Dixie Container Corp., reactivated a long-idle 55,000-tpy medium machine at Sylva, N.C., and converted it from semichemical to recycled furnish.

Corrugated box shipments rose 6.2% in 1984 and corrugated medium production rose by about 7.5% to 6.48 million tons. Semichemical medium output was up 9.1% to nearly 5.2 million tons, while recycled containerboard showed only a slight increase. This would indicate an operating rate of nearly 99% for semichemical medium mills in 1984, while recycled mills ran at about 90% of capacity. Part of this strong performance, however, reflected inventory buildup at box plants and mills which by Jan. 1 had reached 2.8 million tons (8.4 weeks of supply) for both linerboard and medium.

OUTLOOK

Corrugated box shipments are forecast to rise about 2.5% in 1985, but corrugating medium production is forecast to rise only about 1.3%, assuming the liquidation of about 75,000 tons of inventory. With overall corrugating medium capacity expected to rise about the same amount in 1985, operating rates for semichemical medium mills should average more than 98%, while recycled mills will run at about 90% of capacity.

Only one new semichemical medium machine is believed to be under serious consideration. Owens-Illinois Inc. has been studying a new machine to replace an existing machine at its Tomahawk, Wis., mill which would raise net capacity by about 250,000 tons. Approval of the project, however, has been indefinitely postponed. In addition, Temple-Inland Inc. in building a new 175,000-tpy recycled linerboard mill in Ontario, Calif., while International Paper has purchased an idle 130,000-tpy recycled containerboard mill in Riegelsville, Pa. Both of these mills, which will go on line in 1985, could produce some recycled medium. Union Camp Corp., which currently produces no medium, has indicated that it is considering converting a kraft paper machine at its Savannah, Ga., mill to corrugating medium or possibly producing medium on an existing linerboard machine at its Montgomery, Ala., mill.

PRICING

Normally the price of corrugating medium closely tracks the price of linerboard and in recent years the list price for 26-lb semichemical medium in the eastern U.S. has been $10/ton below 42-lb kraft linerboard. The list price for semichemical medium on the West Coast has recently been about $14/ton higher than in the eastern U.S. Recycled medium usually sells for $5 to $10/ton less than semichemical medium, although in a tight market the price may be the same.

The price of corrugating medium fell along with that for linerboard during the 1981-82 recession period. The price of 26-lb semichemical medium reached a peak of $290/ton at the beginning of 1981, but then fell to $260/ton late in the year and eventually slid to $240/ton by late 1982 — a level that was probably unprofitable for most semichemical medium mills. In fact, two

ANNUAL U.S. PRODUCTION OF CORRUGATING MEDIUM

(000 short tons)

	Semi-chemical[1]	Recycled[2]	Total	% change
1983	4,731	n.a.	n.a.	n.a.
1982	4,389	1,357	5,746	− 4.3%
1981	4,717	1,315	6,032	0.5
1980	4,723	1,281	6,004	0.2
1979	4,689	1,301	5,990	2.4
1978	4,439	1,408	5,847	5.4
1977	4,264	1,286	5,550	7.8
1976	4,105	1,040	5,145	14.6
1975	3,702	788	4,490	−15.1
1974	4,175	1,115	5,290	− 3.2
1973	4,260	1,204	5,464	10.3
1972	4,010	942	4,952	8.1
1971	3,700	879	4,579	3.7
1970	3,500	916	4,416	—

1. Source: American Paper Institute.
2. Source: Dept. of Commerce.

companies (Harriman Paperboard Corp. and Consolidated Packaging Corp.) in 1984 filed for protection under Chapter 11 of the federal bankruptcy code. Two price increases in 1983 carried the price back to $280/ton by fall and a further $30/ton price increase Feb. 1, 1984, took the price to $310.

Another $30/ton increase to $340 in the fall of 1984 has been difficult to implement due to slowing demand and high inventories. While this has also been true for linerboard, medium has been under even heavier discounting pressure, according to industry observers. Among reasons cited: recent reactivation of machines, the fact that two mills are operating under Chapter 11, and increased imports of medium into the northeastern U.S. from Canada. Canadian exports of medium to the U.S. for 1984 totaled 94,000 short tons — more than double their level two years earlier, according to Canadian Pulp & Paper Assn. data. Declining wastepaper and fuel oil costs may also be making some recycled medium mills more price competitive.

U.S. PRICES FOR CORRUGATING MEDIUM

(Semichemical, 26-lb, eastern U.S.)

	$ per short ton[1]	$ per 1000 ft²
1984		
4th quarter	310/340	4.03/4.42
3rd quarter	310	4.03
2nd quarter	310	4.03
1st quarter	280/310	3.64
1983		
4th quarter	280	3.64
3rd quarter	260/280	3.38/3.64
2nd quarter	260*	3.38
1st quarter	240*	3.12
Year-end		
1982	240*	3.12
1981	260*	3.38
1980	260	3.38
1979	240	3.12
1978	210	2.73
1977	180*	2.34
1976	200*	2.60
1975	190	2.47
1974	190	2.47
1973	140	1.82
1972	123	1.60
1971	120	1.56
1970	120	1.56

*Indicates some discounting.

[1] List prices on West Coast have generally been high—currently $14.25 above eastern price.

Source: PULP & PAPER PRICEBOOK, 1984.

U.S. exports of semichemical medium, although small (mainly to the Caribbean and Central America), also dropped off sharply in 1984. Production for export, as measured by the American Paper Institute, was off 21% to 151,000 tons; the Dept. of Commerce showed about a 45% drop in shipments to about 40,000 tons.

In early 1985, Great Southern Paper dropped its list price for medium to the $310 level along with its linerboard reduction, and sales of medium were reportedly taking place as low as $280 or $290/ton. Prices, however, were expected to firm in spring due to a combination of downtime by some producers and strengthening box demand.

CANADIAN CONTAINERBOARD MARKET

The Canadian containerboard industry (both linerboard and medium) is much smaller than the U.S. industry, with production of about two million short tons compared to about 20 million tons for the U.S. This reflects the fact that the Canadian industry mainly serves the domestic market, which has a population of only 25 million and an economy about one-twelfth the size of the U.S. economy, Paul R. Bannerman of Etcan Internationale Inc., a Montreal, Que.-based sales agency, noted in a speech before the First International Unbleached Kraft Conference sponsored by *Pulp & Paper* in New York, N.Y., in the fall of 1984.

The Canadian containerboard industry has developed

CANADIAN CONTAINERBOARD PRODUCTION

(000 metric tons)

	Total containerboard	Linerboard*	Corrugating medium*
1983	1,504	1,010	494
1982	1,305	876	429
1981	1,599	1,080	519
1980	1,571	1,113	458
1979	1,489	1,037	452
1978	1,419	1,010	409
1977	1,261	920	340
1976	1,294	950	344
1975	1,014	710	304
1974	1,512	1,091	420
1973	1,450	1,002	448
1972	1,254	839	414
1971	1,076	723	353
1970	1,042	704	339

p = Preliminary.

* Includes some recycled paperboard.

Source: Statistics Canada.

behind high tariff walls and many of its facilities are not competitive in size or scale with mills in the U.S. The higher cost structure for the Canadian industry also reflects the fact that linerboard is a fiber-intensive grade, while the growing cycle for wood in northeastern Canada is slow and harvesting and transportation costs are high. Until 1980, a 15% tariff protected the containerboard industry; under GATT negotiations completed in the late 1970s this will drop by 1987 to 6.5% for kraft linerboard and 4% for corrugating medium.

The evolution toward a more open, internationally competive market has been painful for Canadian producers, according to Bannerman. Since 1977, three containerboard mills have closed — two export-oriented kraft linerboard mills and a recycled liner mill. In total, this has taken about 500,000 tpy of linerboard capacity out of the market. In fact, during the 1974-84 period, production of linerboard in Canada has remained absolutely flat, running at close to a 1.1-million metric tpy rate. Corrugating medium, however, has shown some increase in capacity over the past decade and is running at about a 600,000 tpy production level.

Bannerman noted the following differences between the Canadian and U.S. containerboard industries:

(1) Recycled linerboard has shown dramatic growth in Canada and accounts for about 50% of production, while in the U.S. recycled accounts for only about 2% of total linerboard output. Recycled medium, however, accounts for more than 15% of the total Canadian market, which is slightly less than in the U.S.

(2) The corrugated industry in Canada is almost totally integrated, with independents having well under 5% of the corrugated market (vs roughly 20% to 25% in the U.S.). Two integrated corrugated companies (Domtar Inc. and MacMillan-Bathurst Inc.) account for more than half of the Canadian industry's box production.

(3) More than 25% of both linerboard and medium production is shipped outside of Canada. (Eurocan Pulp & Paper Co. is the largest liner exporter while Consolidated-Bathurst Inc. and Papier Cascades Inc. are the biggest medium exporters.) While imports of board are relatively small, imports of finished boxes have grown significantly. During 1982, a large part of the eastern Canadian corrugated industry was shut down by labor problems, and a number of U.S. box plants located near the border started shipping into Canada. While shipments have decreased since the labor dispute was settled, they are still making the market extremely competitive.

Bannerman said he doubted if another kraft linerboard mill would ever be built in Canada and there could be further shrinkage in existing capacity. Whatever growth there is will be satisfied by recycled linerboard. He predicted that Canadian linerboard demand would increase only 2% annually during the balance of the 1980s vs a 2.9% rate in the 1970s, which in turn was only half the growth rate of the 1960s.

ESTIMATED CONTAINERBOARD CAPACITY OF MAJOR CANADIAN PRODUCERS

Annual capacity (000 metric tons)

	Kraft linerboard	Semichemical medium	Total containerboard	Capacity share (%)
Consolidated-Bathurst	215	120	335	23.5%
CIP	245	85	330	23.2
Domtar	215[1]	61	276	19.4
Eurocan	235	—	235	16.5
Irving (Lake Utopia)	—	95	95	6.7
Cascades	—	85[2]	85	6.0
MacMillan Bloedel	—	72[3]	72	5.1
Crown Forest Industries	35	15	50	3.5

Canadian containerboard capacity (1984): 1.425 million metric tons

1. Excludes 80,000 tpy of recycled linerboard capacity at Mississauga, Ont.
2. Excludes 30,000 tpy of recycled medium capacity at Kingsey-Falls, Que.
3. Excludes 445,000 tpy of kraft liner and 210,000 tpy of semichemical medium at Pine Hill, Ala. Other smaller producers of recycled containerboard and their approximate capacities: Atlantic Packaging, 100; Kruger, 85; Belkin, 60; Trent Valley, 45; Minas Basin, 20.

COATED & UNCOATED KRAFT BOARD

Unbleached kraft paperboard other than linerboard (also referred to as solid unbleached sulfate or SUS) is used for folding carton stock and other miscellaneous end uses.

"Folding" includes clay-coated unbleached kraft and bleached-lined unbleached kraft-backed paperboard for conversion into folding cartons and beverage carriers. "Other" includes miscellaneous uses for unbleached kraft board such as filler in shipping containers; tube, can and drum stock; file folder, tag, automobile panel, etc. These miscellaneous uses are discussed more fully in the section on Converted Products.

A considerable discrepancy exists between the unbleached kraft paperboard statistics from American Paper Institute and from the Paperboard Packaging Council. API's 1983 statistics place unbleached kraft folding-carton board production capacity at about 800,000 tons, while PPC figures indicate that about 428,000 tons of SUS was consumed domestically as folding cartons and beverage carriers that same year. Part of the difference reflects export shipments which totaled about 107,000 tons in 1983 (with possibly more tonnage hidden in miscellaneous categories).

Clay-coated unbleached kraft board usage in folding cartons and carriers has been growing primarily because it offers considerable savings over solid bleached board and greater strength than clay-coated recycled board—the other major grades used in that sector of the industry. According to PPC data, SUS accounted for 4.1% (117,000 tons) of total board used in folding cartons in 1960, rising to 13.1% (434,000 tons) of the total in 1980. It declined in 1981 and 1982 to just under 12% (less than 400,000 tons), but rose again in 1983 to 13.1% (428,000 tons).

Most folding carton SUS is consumed in carriers for holding cans or bottles, such as six-packs for beer or soft drinks, plus a wide range of food and other products. Carrier production in 1983 totalled 301,200 tons, which was up from about 289,000 tons in 1982 and 285,000 in 1981. SUS accounts for the overwhelming majority of the board used in carriers, the remainder being solid bleached and recycled board. Recycled board has been almost pushed out of the market, however, since the introduction of coated unbleached kraft board in the late 1950s.

Carrier board is coated on-machine, normally with a clay coating over a calcium-carbonate precoat, and is made on conventional and modified fourdriniers. Carrier stock used in chilled applications is made with wet-strength additives either in the kraft furnish or the coating or both. Typically, carrier stock has a basis weight of about 84 lb/1,000 ft^2 and 410 g/m^2 and a caliper of 20 to 21 pt (0.021-0.022).

Manville Forest Products Corp. and Mead Corp. together hold nearly all of the carrier board market. Manville has the capacity to produce about 470,000 tpy

UNBLEACHED KRAFT PAPERBOARD CAPACITY FOR FOLDING CARTONS AND OTHER USES

(000 short tons)

	Folding[1] cartons	Other[2] uses
1986e	794	449
1985e	794	449
1984e	794	446
1983	794	441
1982	860	509
1981	804	540
1980	852	529
1979	827	520
1978	650	540
1977	645	561
1976	595	525

1. Includes carrier board.
2. Includes tube, can and drum stock.

Source: American Paper Institute.

of coated kraft board, following the reactivation of a machine at its West Monroe, La., mill which was shut down in mid-1982. The 70,000-tpy machine, which was reactivated in late 1984, will be used, however, to produce a clay-coated linerboard grade which will compete with mottled white and solid bleached linerboard.

In 1978, the West Monroe mill started up a 256-in.-wide Tampella machine with two fourdriniers and two Arcu-Forma twin-wire formers designed to produce a low-density folding cartonboard. After considerable startup difficulty, the No. 7 machine has begun turning out 0.14.- to 0.24-in. cartonboard, marketed under the name "Pearl-Kote," for packaging such products as hardware, toys, sporting equipment, frozen foods, soap, and paper goods.

Mead (through its 50%-owned Georgia Kraft Co. affiliate) produces clay-coated carrier stock at Phenix City, Ala., on a 262-in.-wide fourdrinier machine which has a total capacity of 380,000 tpy. A coater rebuild completed in 1984 at the Atlanta, Ga., plant was expected to increase the company's total coated sus capacity by 100,000 tpy to about 500,000.

Because the clay-coated kraft paperboard market relies so heavily on the beverage carrier business, its future is uncertain. Intensive competition from alternate types of packaging, particularly plastic ring-handles for six-packs of aluminum cans, make it difficult to determine if the loss sustained in this area will be compensated for by cultivating demand in other areas. It appears, though, that since 1982 sus consumption has improved—in fact, it was going against the trend away from non-recycled packaging.

According to industry statistics, in the decade from 1973-83, demand for unbleached kraft board in the folding carton industry rose at an annual average rate of 4.7%, while solid bleached sulfate declined 0.1%. In the same period, clay-coated recycled paperboard usage grew by 2.4%, taking a 39.2% share of the market in 1983 compared with just 31.1% in 1973.

Another factor which depresses demand for beverage carrier stock is the increasing popularity of one- and two-liter-size plastic bottles, which have been replacing smaller bottles for soft drinks which might have been carried in six-pack paperboard carriers. The Plasti-Shield bottle with plastic carrier introduced by Owens-Illinois Inc. five years ago has also been growing in market share.

BEVERAGE CARRIER PAPERBOARD STOCK

	Production (000 tons)	Shipment value ($ million)	Realization value ($/ton)
1983	301	275.0	914
1982	289	271.0	938
1981	285	249.1	874
1980	300	236.9	790
1979	295	217.7	738
1978	285	198.1	695
1977	246	167.0	679
1976	239	150.8	631
1975	235	144.1	613
1974	208	114.4	550
1973	198	92.7	468
1972	194	84.2	434
1971	196	83.9	428
1970	223	92.1	413
1969	251	97.9	390

Source: Paperboard Packaging Council.

Paperboard carrier consumption in some segments of the market, however, has been on the upturn, such as for 12-packs of beer, as well as for premium brand beer and mineral water, both of which are normally sold in bottles requiring a stronger medium for transporting than plastic can provide.

Environmental pressures have also had an indirect effect on the paperboard carrier market. Michigan, Oregon, and Connecticut have passed laws imposing deposit taxes, and outlawing disposable cans and bottles. These laws aim to encourage the use of returnable bottles and the returning of aluminum cans, and should result in the use of more paperboard carriers.

BLEACHED BOARD

GRADE STRUCTURE

Solid bleached sulfate (SBS) paperboard is made from a furnish containing at least 80% virgin bleached woodpulp. Its uses are many and varied but the principal markets are folding boxboard and milk carton stock. The other grades include cup stock; plate, dish and tray stock; and bleached linerboard. An undetermined number of SBS producers also make bristols, which can be difficult to differentiate from SBS (see chapter on Bristols in section on paper grades).

About 50% of bleached boards are coated. Coating formulas vary according to the desired surface requirements and degree of sheet holdout (resistance to liquids). Additives are also mixed in with the stock furnish to give the sheet certain characteristics. In making folding carton, for example, a 5-lb/3,000-ft^2 coat weight—typically a clay coating using an S-B latex as binder—is usually added to the stock. Acrylic binders are also commonly used. In milk carton furnish, synthetic waxes are added to improve holdout properties.

Bleached boards are made in calipers ranging from 10 pt to 28 pt and in three levels of apparent density. Basis weights range from 120 to 300 lb/3,000 ft^2. Sheet density, which is the basis weight divided by caliper, starts at 10.5 lb/pt (lb/pt of caliper on 3,000-ft^2 basis) or less for low-density board such as high-quality folding carton, and goes to 12.0 or more for high-density board. Medium-density board is considered to be in the 10.5 to 12.0 range.

A blend of softwoods and hardwoods in about equal proportions is used to make SBS board. The mix is varied depending on strength, density and printability requirements. For example, softwood content would be higher for milk carton stock because of superior tear and tensile strength requirements.

SBS board is typically made on a conventional fourdrinier, a flat-forming suction type, with a secondary headbox commonly included.

Multi-fourdrinier paper machines, which combine a series of fourdrinier sections on a single machine, are in limited use. They make a composite board known as multi-fourdrinier board (MFB) that is derived from bleached kraft pulp and thermomechanical (TMP) pulp. Bleached kraft is used to make top and bottom layers of MFB. TMP pulp is used for the middle plies. TMP pulp is slightly cream colored, but can give paperboard the appearance of bleached board. The stiffness of MFB may not be any greater than SBS, but its cost is generally lower due to TMP substitution. Another advantage of multi-fourdriniers compared to conventional fourdriniers is the capability to make thicker boards than possible on single fourdriniers.

The only known U.S. bleached board producer making MFB from TMP is Continental Forest Industries Inc. At its Augusta, Ga., mill, a Voith multi-fourdrinier produces a four-ply coated bleached boxboard using TMP for two filler layers and bleached kraft for two outside plies. A main fourdrinier section lays down the

U.S. STATISTICS FOR BLEACHED BOARD

	1984e	1983	1982
Production, 000 tons[1]	4,100	3,198	3,665
Capacity, 000 tons	4,166	4,100	4,123
Utilization rate, %	98.4	95.6	88.9
Exports, 000 tons	500	525	516
Imports, 000 tons	—	—	—
Apparent U.S. consumption			
000 tons	3,600	3,393	3,149
lb/capita	30.45	29.00	27.11
000 tons/$ billion real GNP (1972)	2.21	2.21	2.11

e = Estimate.

[1] All tons are short tons.

bottom ply from bleached kraft. Farther down the wire, two Voith Compact formers apply filler plies of TMP pulp, and the top liner of bleached kraft pulp is also applied with a Compact former.

Machines making high-gloss board use gloss calenders to improve the finish. Most machines use on-machine coaters, but milk carton stock is extrusion-coated off the paper machine, normally at the paper mill.

The majority of SBS board machines trim at around 200 in.; in some cases trim may be as high as 275 in. and as low as 118 in. High-capacity machines are normally dedicated to the production of milk carton stock.

INDUSTRY STRUCTURE

Many bleached board producers have the capability to switch from making SBS board to bristols or market pulp in either rolls (fluff pulp) or in bales. This enables production to be adjusted to market conditions, allowing producers to take advantage of more profitable markets.

This considerable swing capability makes it difficult to determine SBS capacity accurately, and it is felt that capacity is slightly higher than reported. An executive with a major SBS producer estimates 61% of bleached board capacity is generally dedicated to bleached board, 14% to bristols, 3% to pulp, and 22% constitutes swing capacity.

Another impediment to making an accurate assessment of SBS capacity has been a reduction in recent years in basis weight and density requirements of SBS board due to more sophisticated technology. It is possible now to make a lower-density board with stiffness and quality comparable to the higher-density board of several years ago. This has enabled producers to make more units of product from a ton of board, and some observers believe this trend has caused relatively flat tonnage production figures to mask an increase in unit production levels.

Capacity trends. From 1970 to 1979, bleached board capacity grew at a 1.7% average annual rate, but declined 3.9% during 1979-83, causing operating rates to go up to 95.6% in 1983 from 88.9% in 1982. In 1982, about 30 machines with a capacity of 4.05 million tpy were in operation, according to the American Paper Institue.

Industry capacity is expected to increase less than 3% in 1984-86 to 4.255 million tons, API reported in its 1983 capacity survey. Most of the hike is attributed to a 150,000-tpy increase in bleached board production at International Paper Co.'s Texarkana, Tex., and Pine Bluff, Ark., mills. IP will be shifting pulp output to its Georgetown, S.C., mill to free 100,000 tpy of SBS production at the Texarkana mill and will expand its Pine Bluff bleached board capacity by 50,000 tpy. Not included in the capacity projection are plans by Westvaco Corp. to install a 175,000-tpy bleached board machine at its Covington, Va., mill by 1986.

Pricing and profitability. Except for some of the smaller machines, the efficiency of most paper machines is good; however, many machines are integrated into mills with poor economics, due either to labor

BLEACHED BOARD PRODUCTION BY END USES[1]

(000 short tons)

		Cartons		Heavy-weight cup stock	Plate, dish and tray	Liner-board	Other food packaging	Misc. packaging[2]
	Total	Folding	Milk					
1982	3,835	1,819	1,052	348	230	101	253	32
1981	4,070	1,981	1,085	427	245	120	223	49
1980	4,026	2,063	1,015	401	263	—	—	40
1979	3,883	1,999	1,090	341	232	102e	—	119
1978	4,002	1,934	1,048	400	277	159e	—	184
1977	3,882	1,822	1,040	419	296	92	53	160
1976	3,876	1,880	1,050	370	267	103	23	183
1975	3,420	1,540	1,052	329	274	88	—	137
1974	3,827	1,706	1,055	442	322	104	—	198
1972	3,741	1,637	1,006	389	350	139	—	220
1970	3,404	1,395	971	369	317	133	—	219

e = Estimate.

1. Production for both foreign and domestic uses.

2. Includes other food packaging when not included in separate category 1970-1979.

Source: Bureau of the Census.

U.S. CAPACITY FOR BLEACHED BOARDS

(000 short tons)

	Liner-board	Folding	Milk carton & food service	Other	Total	% change
1986e	109	2,087	1,837	222	4,255	1.0
1985e	109	2,052	1,827	222	4,211	1.1
1984e	111	2,036	1,799	221	4,166	1.6
1983	104	2,020	1,758	217	4,100	−3.0
1982	104	1,988	1,812	219	4,123	2.7
1981	108	1,904	1774	229	4,015	−4.0
1980	116	1,954	1,865	246	4,180	−3.2
1979	133	2,080	1,916	189	4,318	2.9
1978	122	1,996	1,899	179	4,197	4.4
1977	97	1,930	1,824	170	4,020	0.6
1976	101	1,915	1,854	128	3,998	5.0
1975	95	1,751	1,859	102	3,807	−2.9
1974	108	1,851	1,848	113	3,920	−0.2
1973	141	1,749	1,899	139	3,928	3.7
1972	134	1,583	1,937	134	3,788	6.1
1971	143	1,455	1,842	128	3,569	2.8
1970	130	1,406	1,739	197	2,472	−2.4
1969	150	1,500	1,689	218	3,557	—

e = Estimate.

Source. American Paper Institute.

CAPACITY FOR BLEACHED BOARDS OF MAJOR U.S. COMPANIES

	Annual capacity (000 tons[1])	Capacity share (%)
1. International Paper	780	19.0
2. Potlatch	522	12.7
3. Continental Forest Ind.	430	10.5
4. Westvaco	415	10.1
5. Federal Paper Board	330	8.0
6. Temple Inland	310	7.6
7. Champion International	265	6.5
8. James River	212	5.2
9. Weyerhaeuser	200	4.9
10. Gulf States Paper	180	4.4
11. Mead	170	4.1
12. Container Corp. of America	162	3.9
13. Georgia-Pacific	160	3.9
14. Gilman Paper	160	3.9
15. Union Camp	45	1.1
16. St. Regis	39	0.9

Total U.S. capacity (1984): 4.100 million tons.
Capacity share of top five companies: 60.4%.
Capacity share of top ten companies: 88.8%.

[1] Short tons.

U.S. BLEACHED BOARD EXPORTS[1]

(short tons)

	API[2]	Census
1983	514,000	—
1982	525,000	620,593
1981	557,000	767,412
1980	545,000	606,000
1979	466,000	508,000
1978	430,000	440,723
1977	389,000	374,823
1976	306,000	352,638
1975	—	284,203
1974	—	374,642
1973	—	265,169
1972	—	208,516
1971	—	183,257
1970	—	129,139
1969	—	131,946

[1] Imports are minor.

[2] American Paper Institute data represent production for export, not shipments.

Source: American Paper Institute and Bureau of the Census.

or equipment. This situation appears to be changing, however, with the trend in the industry being toward labor contract settlements having lower pay hikes and better productivity improvements than in previous years.

SBS board mills in the past have been profitable even when they theoretically would have appeared to be inefficient in design or location, since aggressive pricing and inadequate supply have kept operating rates high. Swing capability has also allowed SBS machines, in times of tight pulp supply, to produce pulp—which is more profitable to make than bleached board; the economics of the two products are similar except for the higher conversion costs of SBS.

The price of SBS in real terms has more than doubled since 1972. Since 1982, though, prices have declined due to poor demand caused by a weak economy. Prices for 16 pt and higher calipers of SBS were rolled back in September 1982 to the June 1981 level of $590/short ton from $625. Lower calipers were rolled back later in the year. Prices began to firm up in 1984, when many producers attempted to return to the 1981 list, but discounting continued. In late spring, the industry attempted another hike, posting lists as high as $665/ton. Although market prices were still well below list and generally around the low $600s, the market appeared to be firming in the second half of the year.

MARKETS

Largest end-use for SBS board is in folding cartons, accounting for 47% of total production in 1982. Milk carton stock made up about 27% of the market; cup and plate, 15%; linerboard, and other packaging and nonpackaging uses, including printing boards and aseptic packaging and ovenable paperboard, about 11%.

Overall production of bleached board rose at a 1% annual rate from 1970-80. During 1982, though, the market was depressed due to the economic slowdown. The market remained sluggish for two years, picking up again late in 1983. Production of bleached board was up 6.9% in 1983 to 3.92 million tons after a drop of 6.3% to 3.67 million tons in 1982. As a result, operating rates rose to 95.6% in 1983, their highest level since 1976, when the rate was 96%. Exports also were up by 1.7% in 1983 to 525,000 tons.

Domestic production of **folding carton** board through May 1984 was up 9.2% over a year earlier, and that gain was shared about equally between market shares for solid bleached paperboard and recycled paperboard. In 1983, production of folding boxboard rose 7.5% over its 1982 low.

The U.S. Bureau of Industrial Economics indicates that since 1980 SBS has continued to lose market share to recycled board in the folding carton market. Industry figures show that clay-coated recycled paperboard, which had been running neck-to-neck with SBS board in the folding carton market in recent years, took the lead in 1981, jumping ahead 7.8% and accounting for 39% of all folding carton shipments, while bleached board shipments dropped behind 4.5%, accounting for 36% of 1981 folding carton shipments. That trend continued through 1983, with recycled staying at 39% while SBS declined to under 35%, giving up some market share to other nonrecycled grades.

SBS and other virgin kraft board together accounted for slightly over 50% of the industry's board consumption when the nonrecycling grades' market share reached its peak in 1981, compared with only 43% in 1972, according to BIE. By 1983, this had dropped off to under 48%, according to industry statistics.

Most of the growing use of virgin board in folding box manufacturing over the past decade has been the result of significantly increased demand for kraft board, especially in beverage carrier end-use and in packaging of toys, cosmetics, and certain food applications. SBS use during the early 1970s also expanded rapidly, but has since leveled off, the bureau notes.

The price differential between SBS and clay-coated recycled board widened from $70 to $80 a ton in the late 1970s to $150 a ton by January 1982, when the list price of a ton of 15-pt coated SBS board was quoted at $625, although some regional discounting was reported. As prices rose during 1983 and 1984, the differential by mid-1984 had increased to more than $100, with clay-coated recycled grades lagging behind and SBS prices gradually moving up, industry observers reported.

Liquid packaging board has been about the weakest segment of the SBS board industry in the domestic market in recent years. **Milk carton** stock sales have declined 5% a year in the last five years, according to

U.S. BLEACHED BOARD PRODUCTION

	Tonnage (000 short tons)	% change
1984e	3,926	7.1
1983	3,665	−4.0
1982	3,819	−2.3
1981	3,910	1.2
1980	3,862	−3.4
1979	3,998	0.6
1978	3,972	6.9
1977	3,717	−3.1
1976	3,838	14.9
1975	3,341	−11.4
1974	3,769	−2.1
1973	3,852	3.9
1972	3,709	8.8
1971	3,408	1.1
1970	3,372	−5.3
1969	3,560	—

e = Estimate.

Source: American Paper Institute.

figures from a major producer, but that downward curve could be reversed in the coming years.

In an attempt to restore some of the milk container market share that paperboard has lost to plastic, the Paperboard Packaging Council launched a national campaign in 1982 to publicize the nutritional advantages of paperboard containers for packaging milk. The campaign is based on those properties of paperboard containers which prevent light from robbing milk of its vitamins, a loss which plastic and glass allegedly allow.

The campaign seems to have worked. Domestic milk carton consumption was up 1.9% in 1983. The paperboard industry had been losing significant volumes of paperboard packaging to the plastic gallon jug each year in the prior 15 years, according to PPC. During the first four months of 1984, the industry reported sales of milk carton stock year-to-date was up by nearly 6%, but the April 1984 figure was down more than 4% from a year earlier.

BIE's forecast for the market is not as optimistic. The bureau's figures indicate that sales of paperboard milk cartons accounted for less than 15% of the real value of the industry's **sanitary food container** shipments in 1983, compared to more than 20% of the 1972 total, with a decline of more than 30% in tonnage over the 1972-81 period.

The bureau cites several factors which should continue to depress sales of milk carton stock. Plastic substitutes have made deep inroads into this market, especially in sizes larger than a quart. In addition, milk carton shipments are also being reduced by various trends in the population. Over the past several years, the fluid consumption of the country has changed from milk to nondairy soft drinks and other beverages. This trend has been supported by the steadily rising average age of the population, concerns about caloric and cholestorol intake, and higher per capita costs of milk.

Export markets for milk cartons, however, remain relatively strong with good long-term prospects. In addition, an increase in sales of domestic **paperboard cans** has also bolstered the liquid paperboard container market. Sales of **juice** have expanded at a rate of 8% to 10% during 1975-80, and these products continue to be a good market. Paperboard cans are used mostly for dry foods such as snacks, and are also suitable for packaging greasy foods, pet foods, powdered drink mixes, yogurt and ice cream.

Aside from providing stiff competition in the milk carton industry, plastics have also eroded use of paper in markets such as **paper cups, plates, trays and other food service products and eating utensils**. The share of total industry sales (in constant 1972 dollars) of paperboard products included in BIE's sanitary food container industry category, though, increased from about 43% in 1972 to 47% or more in 1982. **Paper cups** also expanded their share of total industry shipments over the past decade, increasing from 32% in 1972 to about 34% in 1982, according to the bureau.

Production of bleached board used in the manufacture of sanitary food serving items totalled an estimated 600,000 tons in 1982 compared to 750,000 tons in 1972, according to BIE. Despite stiff competition from nonpaper materials, however, the industry has retained a large portion of its market (other than milk cartons) through improved product quality, appearance, coating technology, and pricing, the government indicates.

One of the few bright spots for the industry in the past few years has been shipments of heat-resistant paperboard trays, which can be used in both microwave and conventional ovens. While reliable data on sales in this relatively new product line—called **ovenable paperboard**—are not available, there is a continuing trend toward the consumption of oven-ready meals which can be prepared and served quickly and with little effort. It is estimated that more than two billion ovenable food trays were sold in the U.S. during 1983, up almost 10% from a year earlier, according to BIE.

Industry analyst Thomas Clephane of Morgan Stanley & Co. Inc. estimates that 30,000 tons of ovenable board was sold in 1983 and he expects the market to increase to 50,000 tons by 1987. This is a substantial drop from initial industry estimates that the market would grow to 200,000 tpy by the mid-1980s.

The newest potentially important market for U.S. SBS board, though, is in **aseptic packaging**, which is used to keep fresh for up to six months, without refrigeration, such perishables as milk and juice. This is done by

U.S. PRICES FOR BLEACHED KRAFT BOARD

($/short ton)

Year-end	15-pt, folding carton, C1S 80 bright (rolls)	Cup stock, uncoated
1984e	625/655	n.a.
1983	590/625	n.a.
1982	590/625	n.a.
1981	625	n.a.
1980	518	n.a.
1979	490	457/468
1978	445	406
1977	405	386
1976	385	364
1975	355	342
1974	350	n.a.
1973	250	n.a.
1972	192	n.a.

e = Estimate.
n.a. = Not available.

Source: PULP & PAPER WEEK.

sterilizing the food and then hermetically sealing it in multi-ply paperboard/foil/polyethylene containers. Aseptic packages have been used in Europe for a number of years, but were introduced into the U.S. market only in 1981 when the Food and Drug Administration approved the use of hydrogen peroxide as a sterilizing agent.

U.S. and foreign-owned companies have rushed to package soft drinks and juices in aseptic containers and sales have been rising rapidly, BIE states. The marketing for aseptically-packaged milk has been far less successful, largely because of consumer adherence to traditional consumption patterns. Demand for aseptic packaging in the U.S. should reach 40,000 to 50,000 tpy by 1987 compared to an estimated 15,000-tpy market in 1983, some industry observers believe.

According to BIE, the advantages of aseptic packages include their extended shelf life, without refrigeration, and lower storage space requirement. In addition, the packages can be produced with less energy than paperboard packages, and they are also price-competitive with other kinds of packages.

The cost of producing aseptic packages has been estimated at 40% that of glass bottles and metal cans, but the packages are more expensive than conventional gable-top cartons or plastic bottles. Both clay-coated multi-ply paperboard and SBS are used by packaging innovator Tetra Pak of Sweden, depending on whether or not flexographic or rotogravure printing is used.

Major food producers such as Borden Foods Inc., Coca-Cola Co., Del Monte Corp. and Ocean Spray Cranberries Inc. have marketed products in these containers around the world. Leading this market has been Brik Pak Inc., a Dallas-based subsidiary of Sweden's Tetra Pak International.

Other suppliers of carton-filling machines are Bloc-Pak Inc., a Toronto-based subsidiary of West Germany's PKL GmbH, and International Paper Co. Producers of aseptic packages are using mainly Swedish-developed technology and equipment, although other foreign and U.S. systems are also being introduced, the bureau indicates.

OUTLOOK

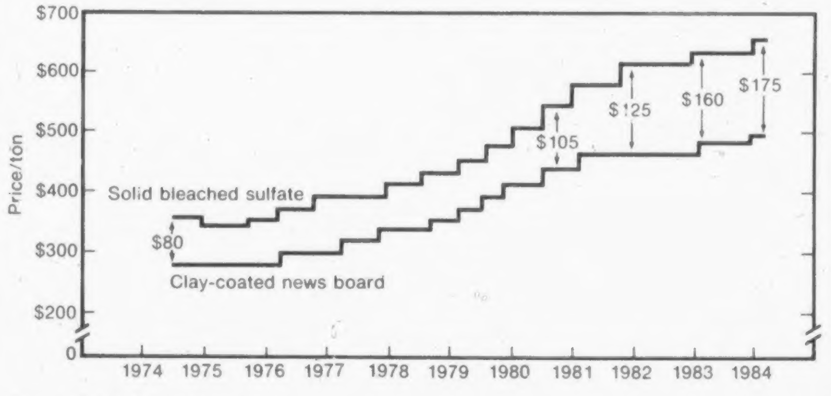
Except for aseptic packaging—and, to some extent, ovenable paperboard—the bleached board industry is mature and is expected to grow at a rate lower than the GNP, according to Clephane. Limited capacity additions should keep markets tight, though, with operating rates in the high 90s.

The largest gains in the market during 1984-87, should be in aseptic packaging, up 26%; miscellaneous other uses, up 4.5%; and export, up 3.5%. Production is expected to rise about 4% in 1984 and 2%-3% in 1985, but only 2% or less in 1986-87, reaching 4.225 million tons by 1987, less than 8% above 1983's total of 3.918 million tons.

Demand for folding carton, milk carton, and cup and plate, will remain relatively flat. Folding carton demand should stay at about the same level as 1979-83 and SBS should continue to lose market share to recycled paperboard and uncoated kraft paperboard.

BIE expects the real value of sanitary food containers to decline in 1984 for the sixth consecutive year, but the drop will be more moderate than in the recent past—only about 1%. The projected decline will be almost entirely due to a continuing reduction in milk carton shipments, though at a lesser rate than in previous years. The positive effects of the industry's new ovenable paperboard and aseptic packaging product lines will start to become apparent but will not be sufficient to overcome the losses incurred by the industry's traditional products, BIE estimates.

FOLDING BOXBOARD PRICE TRENDS



Source: Official Board Markets.

BIE expects milk carton domestic consumption to decline in 1984, although more moderately than in previous years. Others think milk carton board sales are on the upswing. One industry observer expects the growth in exports of milk cartons—estimated at 5% annually—to outweigh a projected decline in domestic sales of about 4% a year, giving the market a net gain of 1% annually until 1987.

Some observers feel the decline in domestic liquid paperboard packaging, particularly milk cartons, is leveling off, and foresee growth in such areas as juice cartons.

Clephane expects the decline in the number of milk-drinking people to continue for at least another five years (1984-89), with a possible increase in that portion of the population in the 1990s. The trend through the rest of this decade, combined with the continued competition from plastics, should keep milk carton shipments level through 1987 at about 600,000 tpy. Export markets, though, still have good growth potential, he notes.

Demand for paperboard juice containers is expected to increase 8% to 10% a year, according to a major manufacturer's estimates. Producers are also enthusiastic about growth projections for paperboard cans, particularly in the export market.

Plate, cup, dish and tray markets are considered to be fairly mature except in the fast-food industry, according to BIE. As more fast-food producers move overseas, export demand should increase, however. Domestic demand for SBS board from the U.S. fast-food industry has been consistently strong and is growing.

U.S. SANITARY FOOD CONTAINERS INDUSTRY: VALUE OF SHIPMENTS AND CONSUMPTION OF PAPER AND BOARD

	1982**		1977*	
	Paper & board consumed (000 sh ton)	Value of products ($ million)	Paper & board consumed (000 sh ton)	Value of products ($ million)
Total: (SIC Code 2654)	—[1]	2,545.6	—[1]	1,951.7
Milk and milk-type cartons[2]	569	550	751	479
Cups and liquid-tight containers	—	885	—	606
Liquid-tight containers[3]	32	64	35	41
Drinking cups[4]	451	821	600	565
Cups[5]	—	.1	—	—
Other sanitary food containers[6]	—	356	—	831
Food serving products				
Stamped plates, dishes, spoons etc.	227	259	216	173
Other paperboard items	32	63	73	43
Other paper items[7]	—	—	21	16
Folding containers for liquid[8]	—	712	—	—
Frozen foods and bakery[9]	196	229	428	341
Butter and ice cream packaging and food pails	155	170	183	138
Processed meats, margarine[10]	83	106	73	70
Others	—	42	—	56

1. Data not collected or available.
2. Including juices, beverages, and other products.
3. Plus round nested food containers, including lids and tops.
4. Plus portion serving cups.
5. And liquid-tight containers not classified.
6. Includes food containers, boards, and trays.
7. Includes tablecloths and soda straws, except glass or plastic.
8. Containers for liquid, moist, oily, or perishable foods, including frozen foods.
9. Including frozen bakery.
10. Plus lard and shortening.

* Source: 1977 Census of Manufactures.
** Source: 1982 Census of Manufactures.

the bureau notes. Depressed resin prices, however, have made plastics a major competitor in this market.

SBS vs recycled. Clay-coated folding recycled paperboard is expected to continue to provide stiff competition for solid bleached in the board market, according to some industry observers. Others, however, feel SBS will regain its dominant share of the market in the future as recycled board mills' costs become more burdensome (see chapter on Recycled Paperboard).

These observers feel that once secondary fiber costs increase recycled board producers will be forced to raise prices to a level which will restore vitality to the bleached board market. BIE expects that more folding boxes will be used for frozen food in the period 1981-86, at the expense of aluminum trays, and this should also benefit the SBS market.

SBS producers are also able to reduce their energy costs through installation of woodwaste-burning boilers, while recycled mills must rely entirely on purchased energy, which may again begin to rise rapidly in cost.

But other marketing executives feel folding carton converters will continue to use more recycled paperboard for certain end-uses in an effort to reduce costs where possible. The most impressive example of this tactic in recent years is Procter & Gamble Co., which in recent years switched to recycled paperboard from bleached board for a significant portion of its disposable diaper cartons.

BIE projects clay-coated recycled board will continue to take a gradually expanding share of the industry's total annual board consumption, although SBS board will probably regain some of its lost market share at the expense of other nonrecycled boards, and the least costly darker recycled grades.

SUMMARY OF SANITARY FOOD CONTAINER INDUSTRY STATISTICS

(SIC Code 2654)

	Plants (total)	Employees	Value of shipments[1] ($ million)	Capital expenditures ($ million)
1982	145	24,700	2,833	67.1
1981	—	28,300	2,691	70.7
1980	—	28,400	2,430	56.0
1979	—	29,800	2,328	65.7
1978	—	28,900	2,086	71.5
1977	193	28,700	2,048	52.4
1976	—	30,600	1,982	53.8
1975	—	28,300	1,775	29.6
1974	—	30,800	1,652	44.5
1973	—	—	1,448	38.0
1972	251	35,100	1,420	42.3
1971	—	—	1,256	33.8
1970	—	—	1,214	39.8

1. Value of industry shipments, not products.

Source: Census of Manufactures.

RECYCLED PAPERBOARD

INDUSTRY STRUCTURE

Recycled paperboard is usually made from 100% wastepaper on either fourdrinier or multi-ply paper machines. Mills are typically small with equipment that is older, slower and less efficient than machines in other sectors of the paper industry. Most recycled mills, however, are close to their markets, enabling them to offer their customers a higher degree of service, and to reduce freight and wastepaper costs.

Grades of recycled paperboard include: (1) folding boxboard, (2) setup boxboard, and (3) paperboard. Most folding boxboard is clay-coated, while most setup boxboard is uncoated. Paperboard includes corrugating medium, linerboard, gypsum linerboard, core, can and tube stock, but does not include any construction papers or boards.

Boxboard grades usually consist of four or more plies. The top layer is made from deinked pulp or other high-quality wastepaper such as pulp substitutes. Middle plies are made with lower quality paper stock such as old news and mixed papers combined with some old corrugated containers for more strength. The fiber content of the bottom layer, or back ply, depends on the strength and appearance sought in the finished product, and fiber choices would include news, corrugated and pulp substitutes.

GENERAL OUTLOOK AND MARKETS

The grade breakdown for recycled paperboard based on 1984 capacity figures is as follows: folding boxboard, 30.4%; setup boxboard, 3.7%; corrugating medium, 17.7%; gypsum linerboard, 13.7%; linerboard, 5.1%; container chip and filler board, 2.9%; other paperboard, 26.3%. Other paperboard includes such uses as tube, can, drum, tag, file folder, match stem, tablet backs, and toys.

Operating rates in recycled paperboard dropped to 74.5% in 1982 from about 82% in 1980 and 1981 because of the economic recession. In 1983, demand began to improve again, sending running times up to about 80%. Analysts expect the upward trend to continue for the next two years. One industry observer expects operating rates of about 83% in 1984 and 85% in 1985. Others feel running times may be even better, with operating rates reaching the high 80s. Production of recycled paperboard is expected to increase to 7.4 million tpy in 1984 and 7.6 million in 1985, up from 7.2 million in 1983 and 6.5 million in 1982.

More capacity has been retired from recycled paperboard than in any other sector of the industry, with more than 2.7 million short tpy, or 34%, of recycled paperboard capacity taken out of production in the 1970s. Machine rebuilds offset the losses, however,

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RECYCLED COMBINATION PAPERBOARD, BOXBOARD, AND PACKAGING GRADES

Album board
Automobile board
Bending chipboard
Blister board
Can stock
Car lining board
Chipboard
Cracker shell board
Core stock
Corrugating medium
Drum stock
Florist board
Innersole
Jute board
Kraft-backed board
Laminating board
Lined board
Manila board
Matchbook board
Mat-finishing board
Moistureproof board
Mounting board
Newsboard
Offset blanks
Patent-coated
Pasteboard
Photo-mount board
Poster board
Pulpboard
Saturating board
Shoeboard
Test chipboard
Test linerboard
Transformer board
Tube stock
Wallboard
Water resistant board
Waterproof board
Wet strength board
White-lined board

keeping capacity relatively flat for many years.

In the period 1983-86, the American Paper Institute expects recycled paperboard capacity to rise 1% annually, reaching 9.009 million tons by 1986, down from API's previous estimate of 9.149 million tons by 1985. This revised figure includes 235,000 tons deducted due to an idled mill which may not be restarted.

Estimates of future capacity levels are subject to a volatile market, which has been weakened by poor demand and high costs. Mills which were reportedly on the verge of bankruptcy early in 1984 were facing closure by year-end if the market didn't improve. Others were thinking of switching grades.

During 1983, a number of producers sold some of their recycled board mills, including Container Corp. of America, Packaging Corp. of America, St. Regis Corp., and Stone Container Corp. In addition, St. Regis closed it Coshocton, Ohio, recycled corrugating medium mill in May 1983.

Moreover, in 1984 some companies were considering expansions or conversions, while others, such as Lawrence Paperboard Corp. in Lawrence, Mass., appeared on the verge of bankruptcy. Temple-Inland Inc. announced early in 1984 plans to build a 175,000-tpy recycled linerboard mill in Ontario, Calif., which is set for startup in late 1985.

One of the largest individual reductions in production capacity occurred in 1980 when Whippany Paper Board Co. declared bankruptcy and idled 450,000 tpy of recycled linerboard, corrugating medium, uncoated paperboard and specialty paperboard production.

The 72,000-tpy Riegelsville, Pa., linerboard and specialty paperboard mill, however, was bought in 1981 by a new corporation called Durham Mills Inc. It was renovated and expanded to produce 135,000 tpy and restarted September 1982, but closed June 1983 due to operating losses and environmental violations. It was expected to restart sometime during the second half of 1984, after securing all necessary environmental permits and additional financing.

Whippany's 120,000-tpy recycled paperboard mill in Clifton, N.J., was sold in June 1984 to Dominick Desiderio, a decendent of Whippany's original owners, but the company's Hanover mill in Whippany, N.J., was still without a buyer as of mid-1984. Early in 1984, Container Corp. of America withdrew from an option to

U.S. AND CANADIAN CAPACITY FOR RECYCLED PAPERBOARD

(000 short tons)

	U.S. annual capacity Recycled paperboard grades					Canadian annual capacity
	Total	Paper-board[1]	Folding & and setup	Gypsum liner	Other[2]	Total boxboard including bleached board
1986e	9,099	2,410	3,090	1,228	2,371	—
1985e	8,971	2,303	3,076	1,228	2,364	894
1984e	8,937	2,301	3,055	1,228	2,353	884
1983	8,847	2,274	3,014	1,220	2,339	870
1982	8,670	2,130	3,007	1,255	2,298	836
1981	8,600	2,121	2,968	1,251	2,260	873
1980	8,617	2,122	2,942	1,238	2,313	890
1979	8,757	2,111	3,019	1,273	2,355	949
1978	8,642	2,015	2,986	1,238	2,403	938
1977	8,699	2,132	3,117	1,112	2,337	833
1976	8,774	2,235	3,155	1,046	2,337	782
1975	8,717	2,221	3,123	1,063	2,310	785
1974	8,680	2,132	3,170	1,100	2,278	714
1973	8,330	1,833	3,182	1,093	2,221	681
1972	8,185	1,785	3,109	1,082	2,209	659
1971	8,078	1,652	3,292	1,031	2,104	—
1970	8,084	1,697	3,381	1,013	1,993	—

e = Estimate.

1. Includes linerboard, corrugating medium and container chip and filler board.

2. Others include tube, can, and drum stock, special packaging boards, and panel and wallboard stocks.

Sources: American Paper Institute and Canadian Pulp & Paper Assn.

buy the Hanover mill after encountering problems in obtaining necessary operating permits. An $80-million renovation, including upgrade of a 500-tpd recycled corrugating medium machine, had been planned by CCA.

The competitiveness of recycled paperboard mills continues to be affected by high energy costs (since they have no spent pulping liquors or wood wastes to burn) and fluctuations in wastepaper costs. The sharp decline in wastepaper prices during the 1982 recession has helped overall manufacturing costs and enabled mills to remain marginally profitable and in a stronger competitive position vs virgin board.

In 1983, however, wastepaper costs began to soar, particularly for some of the low grades such as old corrugated containers and mixed papers, due to a sharp rise in construction that caused gypsum board demand to shoot up. Some wastepaper costs more than doubled by year-end, causing recycled board manufacturers to seek price increases. But demand was still not strong enough to warrant higher prices, observers indicated.

U.S. STATISTICS FOR RECYCLED BOXBOARD AND PAPERBOARD

	1982	1983	1984e
Production[1], 000 tons[2]	6,476	7,234	7,925
Capacity, 000 tons	8,690	8,845	8,937
Utilization rate, %	74.5	81.8	88.7
Imports, 000 tons	32	50	75
Export, 000 tons	158	150	132
Apparent U.S. consumption			
000 tons	6,350	7.34	7,868
lb/capita	54.4	60.8	66.7
000 tons/$ billion real GNP (1972)	4.27	4.65	4.89

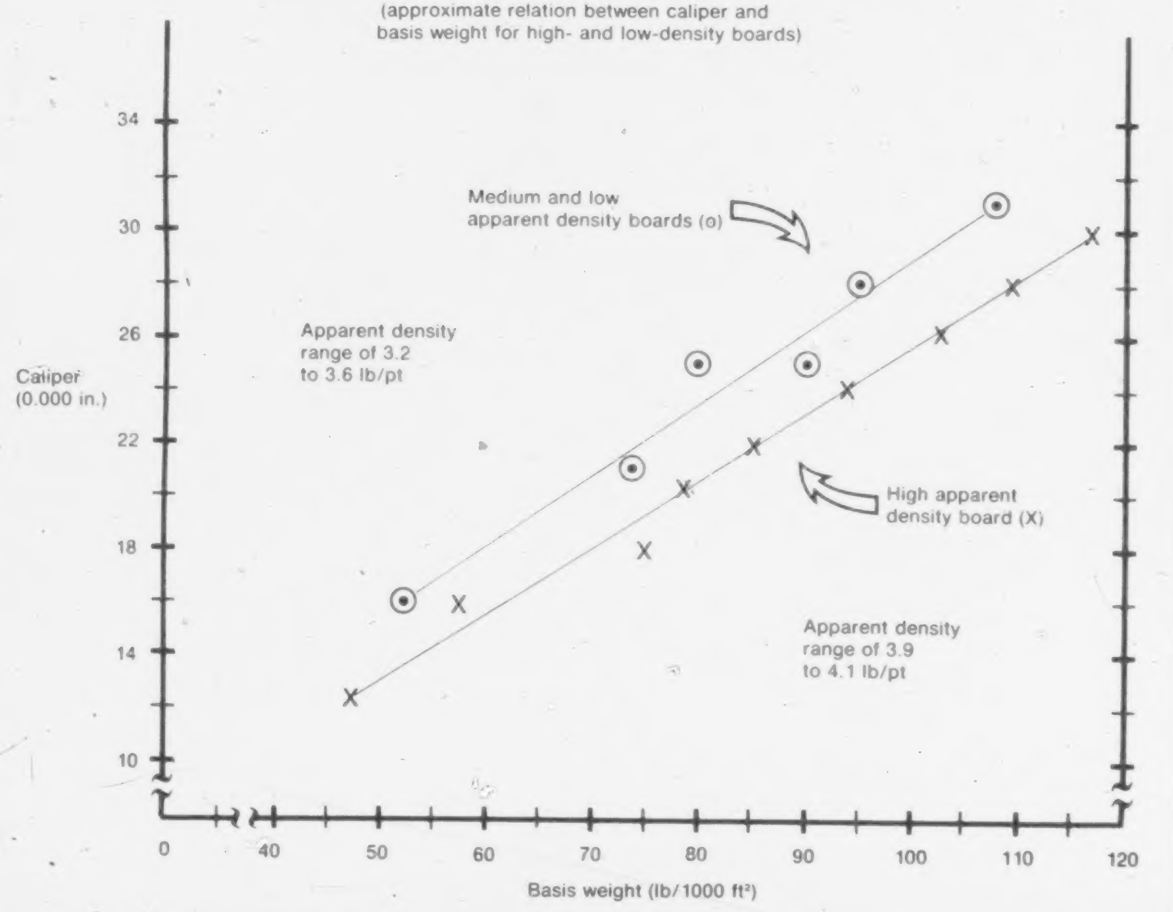
e = Estimate.

[1] American Paper Institute data.

[2] All tons are short tons.

TYPICAL GRADE STRUCTURE FOR BOXBOARD GRADES

(approximate relation between caliper and basis weight for high- and low-density boards)



RECYCLED FOLDING BOXBOARD

Clay-coated grades have a dominant share of the recycled folding carton industry and accounted for 39.2% of all folding boxboard consumed in 1983, according to industry statistics. Other recycled folding boxboard grades such as uncoated bending chip and white and kraft-lined grades accounted for 13% of total folding boxboard output and have been in a long-term decline (down from 25% in 1972). The remainder of the folding carton market consists of solid bleached sulfate (SBS) and solid unbleached sulfate (SUS) grades made

U.S. PRODUCTION OF RECYCLED PAPERBOARD GRADES

(000 short tons)

	Total	Liner-board	Corru-gating medium	Chip and filler boards
1982	1,667	171	1,357	139
1981	1,750	250	1,315	185
1980	2,070	518	1,281	271
1979	2,050	460	1,301	290
1978	1,981	332	1,408	242
1977	1,908	379	1,286	243
1976	1,470	227	1,040	202
1975	1,129	196	788	145
1974	1,766	454	1,114	198
1973	1,741	295	1,204	241
1972	1,476	279	942	255
1971	1,390	263	879	248
1970	1,522	321	916	285
1969	1,624	402	939	283

Source: Bureau of the Census.

CANADIAN PRODUCTION OF BOXBOARD GRADES

(000 short tons)

	Folding[1]	Non-folding	Other	Total
1982e	380	108	207	695
1981	403	130	257	789
1980	424[2]	110	261	795
1979	455[2]	136	291	882
1978	400[2]	188	276	699
1977	368[2]	146	239	612
1976	356[2]	114	199	669
1975	297[2]	103	183	583
1974	259	165	367	791
1973	268	131	426	825
1972	277	120	245	642
1971	258	115	214	587
1970	250	111	233	594
1969	268	125	308	701

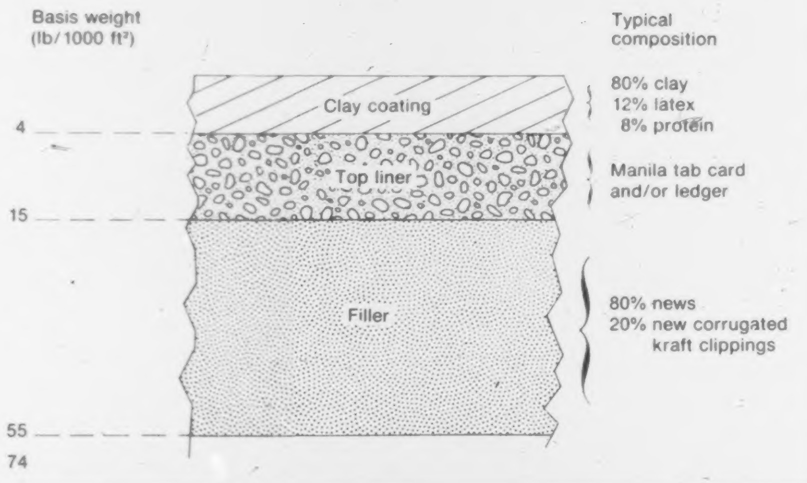
e = Estimate.

[1] Excludes solid bleached board for years 1969 to 1974.

[2] Includes solid bleached board production estimated at approximately 110,000 tpy.

Source: Canadian Pulp & Paper Assn.

COMPOSITION OF 18-POINT CLAY-COATED FOLDING BOXBOARD


Basis weight (lb/1000 ft²)
Typical composition
Clay coating
80% clay
12% latex
8% protein
4
Top liner
Manila tab card and/or ledger
15
Filler
80% news
20% new corrugated kraft clippings
55
74

mainly from virgin fiber.

Clay-coated recycled boxboard, which is coated on only one side on an on-machine coater, is used in dry food containers such as cereal boxes, dry soap boxes, frozen food boxes, and packaging and non-food products, either directly or indirecty.

Quality and productivity have been upgraded in a number of folding boxboard mills by replacing inefficient cylinder board machines with multi-ply formers. Formers such as the Ultra Former have enabled mills to compete more effectively with coated solid bleached board—the major competitor to clay-coated. A lower-density sheet can be produced on these formers than on a conventional cylinder machine, 3.9 to 4.2 lb/pt vs 3.4 to 3.8 lb/pt with newer formers.

During the recession of 1981-82, coated recycled boxboard grades appeared to be competing more effectively against solid bleached boards. When the economy began to recover in 1983 and continued in 1984, though, SBS demand picked up more than recycled clay-coated board in the folding carton market, observers indicated.

Since 1974, the ratio of folding boxboard produced from recycled has remained nearly the same and appears to have improved slightly with some recycled-boxboard-dominated applications such as dry food packaging holding up better through the recession than some heavy SBS uses such as frozen food cartons.

ESTIMATED CAPACITIES FOR RECYCLED BOXBOARD/ PAPERBOARD OF MAJOR U.S. COMPANIES

	Annual capacity (000 short tons)	Grades*
1. Container Corp. of America	781	CB, BB, CM, LB, CS, TS, SP
2. Sonoco Products	600	PB, CS, DS, TS
5. Jefferson Smurfit	535	CB, BB, CM, LB, CS, TS
4. National Gypsum	417	GL, PB, CB, BB, CS, TS, SP
5. U.S. Gypsum	377	GL
6. Carauster Industries[1]	325	BB, GL, PB, CS, TS, SP
7. Newark Boxboard	325	BB, CM
8. Federal Paper Board	300	CB, BB, PB
9. Rock-Tenn[2]	275	CB, BB, GL, CS, SP, PB, TS
10. Mead	265	BB, SP, CS, TS, PB
11. Crown Zellerbach	260	CM, LB
12. Inland Container	240	CM, LB
13. Georgia-Pacific	230	GL
14. St. Regis	196	BB, CS, DS, TS, CB
15. Whippany Paper Board[3]	168	BB, CM, LB, SP
16. Simkins Industries	165	CB, BB, SP
17. James River	160	CB, BB
18. Durham Mills[4]	135	LB, SP
19. Menominee Paper	120	LB, CM
20. Packaging Corp. of America	104	CB, BB, PB, CM, LB, GL
21. Cheapeake Paperboard	85	PB, BB
22. California Paperboard	77	PB, BB
23. Nabisco	68	CB, BB
24. Columbia	65	BB, PB, SP
25. Boise Cascade	64	SP
26. White Pigeon Paper	50	CB, BB
27. Newman	44	BB, SP
28. Cornwall Paper	40	CM
29. Others	2,623	

* Code: BB-uncoated boxboard; CB-coated boxboard; CM-corrugating medium; CS-core stock; DS-drum stock; GL-gypsum liner; LB-linerboard; PB-unspecified paperboards; SP-specialty paperboards; TS-tube stock.

1. Holding company with ownership in Austell Box Board, Sweetwater Paper Board, Carolina Paper Board, and Carotell Paper Board.

2. Includes former Clevepak Corp. 140-tpd Eaton, Ind., mill bought in June 1983.

3. Does not include the Durham, Pa., mill, which was sold in 1981. Whippany's other mills have either been idle or were dismantled since July 1980, leaving the Clifton and Whippany, N.J., mills still salable.

4. Durham bought Whippany's Riegelsville, Pa., mill in 1981 and closed it in 1983. International Paper bought the mill in 1984.

Nonetheless, coated recycled boxboard will continue to be on the defensive, especially for low- and medium-density boards, observers indicate.

In the late 1970s, Continental Forest Industries Inc. and Manville Forest Products Corp. started up new multi-former machines to make virgin boxboard grades. These machines used less expensive furnish than required to make solid bleached sulfate and were said to offer board with improved cost/performance over recycled boxboard. CFI's machine at Augusta, Ga., has capacity to make 150,000-tpy of a boxboard consisting of an inner thermomechanical pulp ply and outer solid bleached kraft plies. The Manville machine at West Monroe, La., is producing a low-density clay-coated unbleached kraft board similar to the company's beverage carrier board for folding carton use. (See section on Coated and Uncoated Kraft Board.)

Performance of both of these machines has been improving after difficult startups, resulting in increased competition for both recycled and solid bleached folding boxboard manufacturers. According to industry statistics, unbleached kraft paperboard accounted for 13.1% of the folding carton industry in 1983, matching its record year in 1980. In 1981 and 1982, the SUS folding carton market share was 11.9% and 11.8%, respectively.

According to Leonard S. Smith, commodity industry specialist for the Bureau of Industrial Economics of the Dept. of Commerce, the value of folding cartons (measured in 1972 dollars) was forecast to increase in 1984 by 2% and should total about 2.7 million tons. This is slightly below the 3.2% rate of growth forecast for the entire paperboard sector, since folding carton growth depends less on consumer spending patterns. The 1984-88 outlook calls for a 1.2% compound annual rate of real growth to a level of about 2.95 million tons of carton shipments by 1988.

RECYCLED SETUP BOXBOARD

Preformed boxes are the primary use for setup boxboard, also called nonbending paperboard or boxboard. Grades include plain chipboard, news vatlined chip, filled news, and white vatlined chip. These grades can be pasted or laminated to form nonbending boards of greater thickness. Setup paperboard is overwrapped with specialty grades of paper for a more attractive box. Candy boxes are probably the most popular end-use for setup boxes, manufacturers indicate.

Setup paperboard is usually made from wastepaper of a lower grade than is used for folding boxboard, because setup boards are not subject to the bending and scoring requirements of folding boxboard.

Basis weights and calipers of setup paperboard range

U.S. PRODUCTION OF BOXBOARD GRADES —FOLDING AND SETUP

(000 short tons)

	Recycled folding boxboard[1]					
	Total	Unlined chipboard	Kraft lined	White lined	Clay coated	Recycled setup boxboard[2]
1982	2,196	—[3]	160	154	—[3]	263
1981	2,425	—[3]	176	189	—[3]	298
1980	2,350	606	81	220	1,443	560
1979	2,386	678	98	229	1,380	604
1978	2,469	706	131	247	1,384	687
1977	2,423	687	133	274	1,330	717
1976	2,508	707	145	313	1,343	747
1975	2,108	564	124	274	1,146	672
1974	2,423	697	137	439	1,149	796
1973	2,652	740	146	520	1,246	998
1972	2,656	793	140	533	1,190	985
1971	2,575	—[3]	—[3]	[3]—	—[3]	979
1970	2727	—	—	—	—	1,042
1969	2,852	—	—	—	—	1,164

1. Bureau of the Census defines as combination bending board.
2. Bureau of the Census defines as combination nonbending board. These boards are used to produce rigid paperboxes, as well as for other uses.
3. Data not available.

Source: Bureau of the Census.

from as low as 15-pt (0.015-in.) to 65-pt (0.065-in.) board. A 15-pt board would have a basis weight of 60 lb/1,000 ft^2 (293 g/m^2).

Setup paperboard capacity has decreased sharply over the last ten years, from about 540,000 tons in 1972 to about 335,000 tons in 1984. Production has been steadily decreasing in recent years, from a high of 519,000 tons in 1968 to 306,000 tons in 1979, 241,500 tons in 1981, 223,600 tons in 1982, etc.

Commerce's Smith thinks the rigid box industry turnaround began in 1983 and will continue through 1988. During 1983, the value of shipments (in 1972 dollars) of rigid boxes increased an estimated 1% after six consecutive years of declining real growth (1976-82). This he attributes to an improved economy and to increasingly successful industry efforts to diversify and expand into new market areas, including folding cartons. Also, plants have been closed and personnel cut back, he said.

During 1984-88, he expects the real value of rigid boxes to increase by an annual compounded rate of 1.5%. Competition from folding cartons and plastics will continue over the forecast period, but the industry is expected to retain its existing market share in high-value specialty packaging.

PAPERBOARD

Recycled paperboard grades—linerboard and corrugating medium—are made on fourdrinier or cylinder board machines.

Recycled linerboard, also called test linerboard, is normally made on a cylinder machine using old corrugated containers in the fiber furnish. Its burst or mullen requirements of 95 to 100 psi are equivalent to 42-lb linerboard made from virgin fiber. For test liner of greater strength, a mill normally increases the weight of the sheet, such as making a 100-test recycled paperboard 48 to 50 lb/1,000^2 compared to 42-lb for virgin linerboard.

Production of test linerboard has remained on a relatively flat trend for years, with sharp cyclical fluctuations. Demand is strongest when the virgin linerboard market is tight, but it can fall off sharply in a recesssion. The limitations on production of virgin linerboard are expected to increase the market for test linerboard later in the 1980s, however. (For a discussion of recycled corrugating medium, see section on Corrugating Medium.)

RECYCLED PACKAGING/INDUSTRIAL CONVERTING PAPERBOARDS

Gypsum linerboard, which is used on the front and back of gypsum wallboard, is generally made by integrated producers of construction papers and boards. The major producers, which comprise about 60% of total U.S. capacity, include U.S. Gypsum Co. (377,000 tpy), National Gypsum Co. (335,000 tpy) Georgia-Pacific (230,000 tpy) and Celotex Corp. (92,000 tpy).

Gypsum linerboard markets will probably remain strong in the long-term because there are few products offering comparable qualities at such a low price. But the market itself can be volatile in the short-term, relying heavily on interest rates, which determine construction activity.

In 1981, the gypsum wallboard market was down by about 20% from the previous year and in 1980 sales dropped about 20% from a good year in 1979, according to industry observers' estimates. In 1983-84, though, demand for gypsum wallboard soared as interest rates dropped and pent-up demand led to a run on orders. Production of gypsum wallboard facings was up 52% in the first quarter of 1984 compared with a year earlier.

ESTIMATED CAPACITIES FOR RECYCLED BOXBOARD/PAPERBOARD OF CANADIAN COMPANIES

	Annual capacity[1] (000 short tons)	**Grades***
1. Belkin Paperboard	390	CB, PB, CM, LB, GL, CS
2. Georgia-Pacific	110	BB, PB, TS, GL
3. Trent Valley Paperboard Mills	100	BB, CS, PB, TS, SP
4. Atlantic Packaging Products	100	CM, LB
5. Kruger Pulp & Paper	100	LB, CS, TS
6. Sonoco	63	PB, CS, TS
7. Strathcona Paper	52	BB, PB, SB, CB
8. Minas Basin Pulp & Paper	30	BB, PB, CS, LB, TS, PB
9. Others	314	

1. Does not include solid bleached folding boxboard grades.
2. Code: BB-uncoated boxboard; CB-coated boxboard; CM-corrugating medium; CS-core stock; DS-drum stock; GL-gypsum liner; LB-linerboard; PB-unspecified paperboard; SP-specialty paperboard; TS-tube stock.

according to API.

Core, drum, and tube stocks are produced by a number of recycled paperboard manufacturers for use in fiber-based cans, tubes, and drums. This is a highly integrated industry and paperboard producers such as Sonoco Corp. operate core, drum, or tube converting facilities at their paperboard mills, or have converting plants located nearby. Converting plants and paperboard mills are located close to markets since the cost of shipping bulky cores, drums, or tubes for any distance is prohibitive.

ANNUAL U.S. CAPACITY FOR RECYCLED FOLDING AND SETUP BOXBOARDS

(000 short tons)

	Folding	Setup
1986e	2,754	336
1985e	2,740	336
1984e	2,720	335
1983	2,681	362
1982	2,676	352
1981	2,638	321
1980	2,593	349
1978	2,568	418
1976	2,705	450
1974	2,665	505
1972	2,607	502
1970	2,805	576
1969	3,029	577

e = Estimate.

Source: American Paper Institute.

U.S. DOMESTIC PRODUCTION OF FOLDING BOXBOARD FROM RECYCLED FURNISH AND SOLID BLEACHED AND UNBLEACHED BOARDS

(000 short tons)

	Recycled	Solid	Ratio (recycled/ solid)
1982	2,076	2,257	0.92
1981	2,261	2,327	0.97
1980	2,235	2,260	0.99
1978	2,321	2,384	0.97
1977	2,367	2,179	1.09
1976	2,340	2,375	0.99
1974	2,281	2,146	1.06
1972	2,477	1,962	1.26
1970	2,473	1,607	1.54
1965	2,659	1,220	2.18

Source: American Paper Institute.

There was a substantial shifting in core, tube and drum stock market shares in 1982 as Container Corp. of America and Owens-Illinois Inc. got out of the business. CCA sold its composite can division to Sonoco Products Co., making Sonoco the second largest producer with an estimated 22% of the market (Boise Cascade Corp. maintains about a 50% share). O-I closed its last plant in April 1982, after having sold seven and closed two others the previous year.

According to Commerce Dept., the value of shipments of composite cans, drums, tubes, cores and similar items increased by 3% (1972 dollars) in 1983, recovering the loss in real shipment value suffered in the 1982 recession. Prior to the 1981-82 recession, fiber drums were considered the product group with perhaps the greatest growth potential in the industry, having competed very successfully against metal drums in recent years.

Composite oil cans have achieved the largest expansion of any of the industry's major product lines in recent years, as quart-size fiber cans captured an increased share of do-it-yourself retail sales from all-metal cans.

U.S. PRICE TRENDS FOR FOLDING BOXBOARD GRADES

($/short ton)

	20-pt clay-coated 80 bright (rolls)[1]	20-pt chipboard bending (rolls)
1984		
3rd qrtr	370/425	300
Year-end		
1983	370/425	280/300
1982	380/425	280
1981	400/425	270/280
1980	380/400	260/275
1979	355	260/280
1978	305	225
1977	284	219
1976	262	212
1975	257	204
1974	*	196
1973		143
1972		116
1971		111

* Data not available.

[1] Some prices higher on West Coast.

Source: PULP & PAPER WEEK, PULP & PAPER WEEK DATABOOK.

The real value of shipments of fiber cans, tubes, drums and similar products is projected to increase 3.5% in 1984. The fiber drum sector is expected to record the largest gain among the industry's major product groups—approximately 5%. The industry is expected to achieve a 2.5% annual rate of growth in the 1984-88 period.

The relatively new market areas for the industry's containers should continue to expand through the forecast period. Fiber drums will continue to gain market share at the expense of steel drums, but at a lesser rate than in the past. Composite cans will experience increasing competition from plastic bottles in motor oil end-uses, although this loss of market share will be partly or fully offset by the growth of composite cans for aseptic and hotfill beverages. Pet food and powdered drinks are new markets for composite cans. (See section on Converted Products.) Over the forecast period, the industry as a whole will actively strive to improve graphics, competitiveness, moisture barriers and crush resistance.

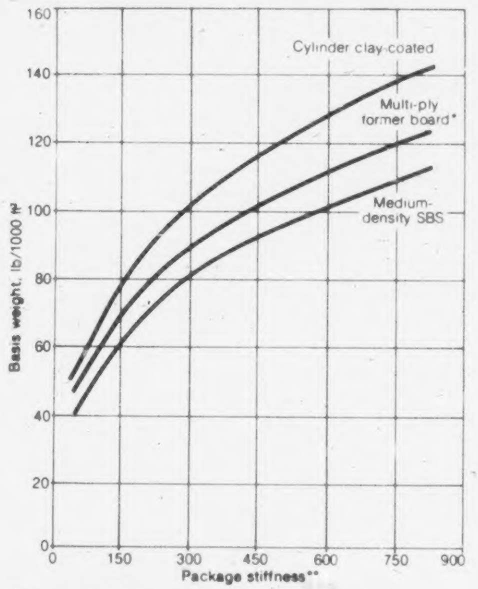
Basestocks for tube, core and drum stock are made in a variety of basis weights and strength ranges. For cores, the principal test is crush resistance. Typically, a kraft outer ply such as a 13-pt (0.013-in.) virgin kraft wrapper is used for core stock. The inner layers are made from semichemical furnish, high yield kraft or recycled furnish. In most cases, recycled boards use, for example, 17-pt (0.017-in.) caliper core stock. When making tube or core stock, the parent rolls are cut into rolls about 5.0-in. wide. Standard cores have a 3-in. diameter and varying wall thicknesses, with ⅜- and ½-in. wall thicknesses being common.

Production of unbleached kraft paperboard for tube, can, and drum stock is not included in the data for recycled paperboard. Census reports that around 200,000 tpy are used in this application (referred to in introduction on Paperboard).

Panel and wallboard stocks are used to produce thick, rigid boards used for construction, automobiles,

COMPARISON OF PACKAGE STIFFNESS FOR GIVEN FIBER WEIGHT

(SBS board produced on fourdrinier machines, recycled fiber board made on conventional cylinder and on multi-ply formers)



*Assumes basic board density @ 3.5 lb/point/1000 ft^2 coating weight @ 8 lb/1000 ft^2

**Package stiffness = (MD stiffness)$^{0.33}$ X (CMD stiffness)$^{0.667}$

Source: Fibreboard Corp. and Arthur D. Little Inc.

Source: PULP & PAPER, December 1978.

TYPICAL GRADE STRUCTURE FOR TEST LINERBOARD

Basis weight[1] (lb/1,000 ft^2)	Caliper[1] (0.001-in.)	Mullen[1] (psi)
42	12	80-85
47	13	90
48/52	13/15	95/100
69	19	130

1. Tests are approximate. These grades supplied in other weights and at different levels of mullen.

U.S. EXPORTS AND IMPORTS OF RECYCLED PAPERBOARD

(000 short tons)*

	Exports[1]	Imports[2]
1983	150	50
1982	158	31
1981	174	40
1980	249	57
1979	176	42
1978	203	47
1977	268	28
1976	306	13
1975	262	8
1974	283	34
1973	207	33
1972	163	8
1971	168	17
1970	151	10
1969	143	11

*Data since 1981 from American Paper Institute.

1. Bureau of the Census data for total recycled-furnish paperboard.
2. Bureau of the Census data for test containerboard and other paperboard.

or trailers. The basestock is produced on cylinder board machines and then pasted or laminated together to make panels or wallboards of the different thicknesses. Wall and panelboard stocks are made by a limited number of producers (such as Upson Co. of Lockport, N.Y.; Haverhill Paperboard Corp. of Haverhill, Mass.; and Simplex Industries Inc. of Constantine, Mich.). The long-term market for these grades has been static, although demand tends to fluctuate with trailer production and new construction.

Other recycled paperboards include a wide range of specialty boards for printing and construction, as well as for a variety of specialty packaging uses such as railroad board, poster, mill bristols, and trailers. Specialty uses are expected to continue to experience their considerable growth trend of the last few years, with the many current producers increasing their own production.

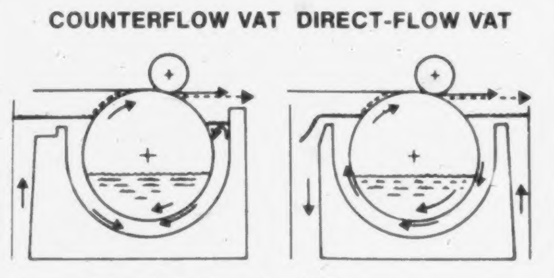
FORMING METHODS

In the last two decades, recycled combination board grades have lost much of their competitive edge to fourdrinier board grades, especially to solid bleached sulfate (SBS) paperboard. SBS boards are produced from blends of virgin softwood and hardwood pulps, and secondary fiber is rarely used. With a fourdrinier, SBS boards can be produced at much higher production rates and with somewhat lower density and MD/CD stiffness or grain ratio than for recycled boards. The fourdrinier, however, is limited in the caliper ranges it can offer.

Solid bleached sulfate boards are usually produced in calipers ranging from 9 to 28 pt (0.009 to 0.028 in.), although they rarely exceed 20 pt (about 75 lb/1,000 ft^2). Cylinder board machines normally produce boards in calipers ranging from 9 to 45 pt (.009 to 0.045 in.), with most cylinder machines able to produce a wide range of combination paperboard, folding and setup boxboards, corrugating medium, gypsum linerboard, and chipboards.

Outside North America, a substantial amount of test linerboard is produced on multi-ply formers. The typical cylinder machine with an open stock-flow system and conventional cylinder mold and vat is limited in its performance. Due to centrifugal forces, it is difficult to operate a conventional cylinder board machine at speeds over 600 fpm. Such grades would have a tensile ratio of 4:1 (MD/CD)), and no better than 3:1.

The conventional cylinder mold rotates opposite to the stock flow (counterflow vat). Stock is formed on a wire-covered cylinder mold by the pressure differential


COUNTERFLOW VAT DIRECT-FLOW VAT

Source: PULP & PAPER, December 1978.

FOLDING CARTON INDUSTRY BOXBOARD GRADE TONNAGE MIX

	1983	1982	1981	1980	1970	1960
Total kraft	47.8%	46.8%	48.0%	50.4%	40.9%	19.9%
Solid bl. sulfate	34.7	35.0	36.1	37.3	31.9	15.8
Solid unbl. sulfate	13.1	11.8	11.9	13.1	9.0	4.1
Total recycled	52.2	53.2	52.0	49.6	59.1	80.1
Clay-coated news	39.2	40.0	38.8	35.6	29.7	12.9
Other recycled	13.0	13.2	13.2	14.0	29.4	67.2
Chip	n.a.	4.6	5.0	4.7	9.7	12.6
Bleached manila	1.7	2.1	1.8	2.1	5.1	15.8
Patent ctd. news	1.4	1.3	1.6	2.0	9.2	29.8
Laminated	3.8	3.6	3.2	3.5	3.9	7.0
Misc.	1.6	1.6	1.6	1.7	1.5	2.0
Total kraft & recycled tonnage (000 short tons)						
	3,264	3,219	3,274	3,311	3,075	2,856

Source: Paperboard Packaging Council.

inside and outside the cylinder mold. The sheet, or ply, is couched off the top of the cylinder by a felt and ply. Counterflow systems produce a sheet with high fiber orientation in the machine direction. As speeds are increased, sheet formation becomes poorer; with significant sheet variations, a decrease in weight pickup results.

Sheet formation can be improved somewhat by using a direct vat where cylinder mold rotation is in the same direction as stock flow. And additional improvement in formation can be achieved by use of a dry vat. The dry vat principle, also called half vat, was developed by the Boxboard Research & Development Assn.

UPGRADING CYLINDER MACHINES

A number of approaches are offered for upgrading conventional cylinder formers. The easiest and least expensive way is to add new slice or headbox designs (pressure formers) to existing cylinder machines. This will give better control over grain ratios and better dewatering will result. Such units are speed-limited and rarely exceed 600 fpm, however. Units such as the Stevens Former (Beloit Corp.) and Sandy Hill Corp.'s Rotoformer use vacuum suction to increase dewatering.

In the late 1960s, Kobayashi Engineering Works Ltd. introduced its first former, which it called the Ultra Former. This series of formers became known as cylinder-on-top-formers. In these the sheet is formed and dewatered on top of a cylinder mold or drilled shell and travels downward from the slice to be transferred to the top of a carrier felt of fabric.

The Kobayashi former was designed to replace individual vats on cylinder machines. The Ultra Former permits the felt pickup to wrap the cylinder mold, thus eliminating dropoff, a problem common to conventional cylinder vat machines. The Ultra Former also was able to produce a somewhat lower-density sheet than possible with conventional cylinder vats.

Another new former, the on-top cylinder former with dewatering wires, is designed to be used with fourdrinier formers, but can be used in some cases in place of a conventional cylinder vat.

Multi-ply boards can also be produced on modified fourdrinier machines. Two approaches are as follows: (1) small fourdriniers are positioned on top of a long fourdrinier section, and (2) on-top formers are positioned on top of a fourdrinier section. Beloit has a different approach for making lightweight multi-ply on a fourdrinier by using a headbox (Strata-Flo/Converflo) which can simultaneously deliver a two- or three-ply sheet to a fourdrinier wire or twin-wire former.

Twin-wire formers made an early debut into multiply forming, but were used on only a limited basis until the 1970s. The first twin-wire former was jointly developed by St. Anne's Board Mill in England and Walmsley (Beloit). It was called the Inverform and became the forerunner of all twin-wire formers. Inverform units were placed over a conventional fourdrinier table and considerable dewatering was achieved through the top wire via drainage in an upward direction.

By the 1970s, a number of machine manufacturers had developed their own versions of twin-wire formers.

U.S. PRODUCTION OF SPECIAL RECYCLED PACKAGING AND INDUSTRIAL CONVERTING PAPERBOARDS

(000 short tons)

	Total	Gypsum linerboard	Tube, can & drum stock	Panelboard wallboard stock	Others
1982	2,040	853	506	114	587
1981	2,144	809	634	100	601
1980	2,262	1,036	564	113	548
1979	2,543	1,210	628	137	568
1978	2,453	1,185	601	119	546
1977	2,378	1,099	680	113	485
1976	2,205	963	701	86	454
1975	1,913	821	630	67	395
1974	2,228	960	733	67	467
1973	2,403	1,051	763	94	493
1972	2,278	1,053	728	117	380
1971	2,048	936	641	105	366
1970	1,739	807	573	90	270
1969	1,771	847	527	113	285

Source: Bureau of the Census.

Based on its experience with the Inverform, Beloit developed its Bel Bond former. The Bel Bond has better dewatering and speed characteristics and, like the Inverform units, can be positioned over a fourdrinier wire to form a multi-ply board.

Kobayashi's Ultra Former, introduced in 1975, combines flat-forming and centrifugal water removal with a second fabric wire, but with the sheet formed before the meeting of the twin forming fabrics. The sheet is transferred to a felt where it is plied to the preceding layer carried by the felt.

WET MACHINE BOARD

GRADE STRUCTURE

Wet machine board products are made from wet boards. The board is made on a single cylinder, or multi-ply machine, such as a Rotoformer. It is formed by building up layers of fiber that are picked up by a press and wound around a top roll. The board is then cut off the roll, and may be pressed, treated and dried. For higher grades such as binder board used for book covers, the board is supercalendered for more smoothness, density and stability.

Typical grades for wet machine-produced board are shown below:

ESTIMATED ANNUAL CAPACITIES FOR WET MACHINE BOARD OF U.S. COMPANIES

(000 short tons)

1. The Davey Co.	36.5
2. Lydall Inc.	30.4
3. Shryock Brothers Inc.	32.5
4. Spaulding Fibre Co.	6.2
5. Quin-T Corp.—Pennsylvania	4.7
6. Penacook Fibre Co.	3.0

A major portion of the furnish used to produce wet machine board is secondary fiber, including such grades as white and colored ledgers, computer printout, old news, old corrugated containers, and mixed papers.

INDUSTRY STRUCTURE

Only a few companies produce wet machine board, and most make less than 10 tpd. U.S. capacity has varied considerably in the past few years from a high of 217,000 tons reached in 1975 to a low of 145,000 in 1978. After creeping up to 163,000 tpy in 1980, capacity is expected to remain relatively flat through 1986, reaching just 151,000 tons.

MARKETS

Demand for wet machine board appears to have suffered, to varying degrees among the various end-uses, from increasing popularity of cheaper substitutes such as chipboard for binder board or plastic for luggage and trunks. A few years ago, plastics also threatened the binder market, but it appears that the market is still dominated by wet machine board.

Deterioration in markets during the recession of late 1981-82 reduced wet machine board mill operating rates to about 80%. At the time, observers were uncertain if reduced demand was due to the economy or was an indication of long-term deterioration in markets. Production estimates since that time have shown a continued slide in demand.

In 1982, the Department of Commerce estimated production at between 50,000 and 100,000 tons, down from the 160,293 tons reported in 1981, the last year for which figures for wet machine board were broken out. Since 1981, Commerce has combined wet machine board and recycled paperboard production figures in order not to reveal individual producer figures. In recent years, the number of producers has declined, while the remaining companies have gained a larger share of the market (see table).

The American Paper Institute, which continued to

WET MACHINE BOARD GRADES

Binder
Counter
Electrical insulating
Innersole
Pattern
Pressboard
Shoe
Shank
Suitcase
Template
Trunk

publish production figures for wet machine board after 1981, estimated that production reached 129,000 tons in 1982 and would rise to 140,000 tons in 1983. Declining capacity boosted operating levels in these years to a high of 92% in 1983.

Producers which have stayed in business generally have been involved in segments of the market which have not diminished significantly, or have kept pace with new technology. A Lydall Inc. spokeswoman said the company has been able to maintain profits through specialization. Products are designed specifically for the customer, she noted. These include such end-uses as special filters and gaskets.

The Davey Co., on the other hand, has kept its wet machine board operation viable primarily by concentrating on the market for binder board, which is used as cover stock for textbooks and high-quality hard-cover books. With another baby boom expected to be in the schools in the next several years, the demand for books should keep the binder board market active for some time to come.

Hard-cover book publishing is one area of uncertainty for the long-term future, however. The spread of video display terminals and the increasing popularity of paperback books could reduce the number of hard-cover books published and curtail the book binder market, one of the biggest consumers of wet machine board, some feel. Others, though, note that VDTs have barely made a dent in the market and are not being as readily accepted as initially projected.

Imports, however, are a major concern to some wet machine board producers, particularly those which make products used in imported goods. The influx of finished goods into the U.S. in recent years due to the strong U.S. dollar has affected such markets as shoe fiberboard and luggage board to a great extent, some observers report.

CAPACITY AND PRODUCTION OF WET MACHINE BOARD IN U.S.

(short tons)

Year	Capacity	Production*	Imports	Exports
1986e	151,000	—	—	—
1985e	151,000	—	—	—
1984e	151,000	—	—	—
1983	152,000	—	3,584	11,622
1982	160,000	129,000	1,842	11,089
1981	161,000	160,293	1,684	10,812
1980	163,000	137,649	2,118	8,017
1979	154,000	144,059	2,340	7,371
1978	145,000	136,000	2,614	7,554
1977	180,000	128,070	3,608	8,351
1976	216,000	129,955	6,988	6,617
1975	217,000	115,169	3,814	6,136
1974	188,000	143,862	5,899	11,287
1973	182,000	148,892	—	—
1972	181,000	147,914	—	—
1971	202,000	137,825	—	—
1970	166,000	139,055	—	—

*Data not available after 1981.
e = Estimate

Source: American Paper Institute and Bureau of the Census

CONSTRUCTION PAPER & BOARD

GRADE STRUCTURE

Construction papers and boards are generally unfinished goods that are eventually converted into finished building products. Grades are divided into the following three categories: (1) **insulating boards** of less than 31 lb/ft³ apparent density, (2) **hardpressed boards** of greater apparent density than 31 lb/ft³, and (3) **construction papers**.

Mechanical pulps or wastepaper are used in the manufacture of construction papers and boards. The U.S. Dept. of Commerce reports that wastepaper makes up approximately half of fiber furnish used to produce construction papers and boards, although secondary fiber can comprise as much as 77% of the finished product, as it does in cellulose insulation. The use of wastepaper in the furnish is expected to continue to decline, however, and the use of fiberglass and plastic foam in making such products as roofing and insulation is expected to rise. But other industry groups feel secondary fiber usage will increase.

Data Resources Inc. reports that 1.117 million short tons of wastepaper were used to make building papers in 1982, compared to a record 1.794 million tons in 1979. The ratio of secondary fiber to other fibers in total building paper and board is expected to rise to 34% in 1993 from 29% in 1982, according to DRI. The largest gains will be in usage of old corrugated containers, up to 10% from 8%, and in mixed waste, up to 14% from 13%.

A report by Franklin Associates Ltd. indicates that the use of recyclable paper in construction paper and board production is expected to rise to 1.830 million tons by 1990 and 2.220 million tons by 2000 compared with 1.543 million tons in 1980.

Total building paper and board production, however, appears to be on a decline, amounting to only 3.9 million tons in 1982, 30% below its 1979 level, and it is not expected to return to the 1979 level for the remainder of the decade due to loss of market share to alternate materials and depressed housing activity.

Building paper and board production is concentrated in the U.S. South, which represents 47% of total U.S. production. The Northeast, North Central and Western regions have 17%, 22% and 14% of total U.S. production, respectively, according to DRI.

The regional share growth will favor the South over the next 10 years due to the high rate of building activity in that region. Southern building paper and board production will grow from 47% of the U.S. total to 50% of the U.S. total. The Northeast and North Central regions will show the sharpest decline in share, while the West's share of production will remain constant at 14%, DRI estimates.

U.S. INDUSTRY STATISTICS FOR CONSTRUCTION PAPER AND INSULATING BOARDS

	Value of shipments[1] (million $)	Employees (000)	New capital expenditures (million $)
1982[2]	366.1	3.6	14.5
1981	540.1	6.5	26.8
1980[2]	528.0	6.7	40.4
1979[2]	549.8	7.1	47.7
1978[2]	526.9	6.9	18.9
1977[2]	473.7	7.0	16.6
1976	428.7	7.6	19.0
1975	486.9	9.4	26.2
1974	546.7	11.1	62.6
1973	488.9	11.3	26.4
1972[2]	456.2	11.6	18.8
1971	465.7	12.2	18.2
1970	396.8	11.8	17.6

1. Does not include data for hardpressed boards and includes only the value of shipments of the products classified in this industry classification. Total value of shipments for construction papers would be slightly higher.

2. Data from Census of Manufactures. All other years estimated.

CONSTRUCTION PAPERS

Most **construction papers** are used to make roofing felts that are converted into asphalt roofing tiles. Construction papers are also used to a lesser extent in automobiles, flooring and sheathing. Wood flour and sawdust are generally blended with wastepaper or fiberglass in making roofing. This increases the sheet's porosity, enabling it to absorb asphalt more readily when asphalt tiles are manufactured.

Fiberglass tiles have become more popular in recent years, reducing the amount of wastepaper used in making roofing. The two principal basis weights of roofing produced are 28- and 55-lb sheets (480 ft^2 basis).

Fiberglass uses about 30% less asphalt than paper-based felt because fiberglass does not have to be impregnated with asphalt before asphalt coating takes place, whereas organic felt must go through both stages of asphalt treatment. Fiberglass has a high fire-resistance rating—an "A" compared with " C" for paper-based felt—and also has a longer life span than organic felt.

Roofing felt is usually made on a cylinder board machine, mainly with a single-vat former. Fourdriniers are used to produce wet-laid glass mat, however. They have an inclined wire to allow for the heavy drainage requirements of fiberglass. Most glass mat is made by a wet process, although manufacturers such as Certain-Teed Corp., and reportedly Owens-Corning Fiberglas Corp., make some mat from a dry process. Of the machines of this type installed so far, the majority are in the 60- to 80-tpd class, 117- to 156-in. wide, producing a mat consisting of 80% fiberglass and 20% binder. Sandy Hill Corp. and Voith Inc. are the major suppliers of machines.

BUILDING BOARDS

Insulation board and **hardboard** are the two subcategories of building boards. Also referred to as building fiberboards, they are wood-based fiber panel materials. Insulation board is considered a product of the paper industry, while hardboard, like panelboard, is made by solid wood manufacturers.

Insulation board is made from defibrated woodpulp or bagasse on fourdrinier paper machines. Rarely is wastepaper used. Hardboard, which is also called hardpressed board, is made under a different manufacturing process that involves using pressure and heat to consolidate the fibers. Hardboards are generally classified into three degrees of density (referred to in table) on properties of wood-based building fiberboards).

Insulation boards are less dense than building boards (below 31 lb/ft^3). They are made in a number of thicknesses, such as ½-in., and production is usually reported on an area basis rather than a weight basis. Insulation boards are divided into two classifications—semirigid and rigid.

Semirigid insulation boards are more pliable than rigid insulation boards but are able to keep their shape when bent, fastened, cemented, or framed. They are used for sound insulation in telephone booths and stereo speakers; in cushioning for furniture and packaging; and in heat insulation for vehicles, railcars,

U.S. PRODUCTION OF CONSTRUCTION PAPERS AND BOARDS

(000 short tons)

	Construction papers	Insulating boards	Hardpressed boards
1982	2,579	729	1,465
1981	1,150	846	1,858
1980	1,369	1,051	1,970
1979	1,868	1,263	2,306
1978	1,915	1,416	2,294
1977	1,851	1,403	2,237
1976	1,771	1,434	2,110
1975	1,616	1,249	1,784
1974	1,845	1,295	1,978
1973	1,858	1,547	2,001
1972	1,915	1,529	1,908
1971	1,837	1,446	1,718
1970	1,594	1,219	1,463
1969	1,603	1,352	1,421

Source: Bureau of the Census.

U.S. STATISTICS:[1] CONSTRUCTION PAPERS

	1982	1981	1980
Production, 000 tons	385	616	1,369
Capacity, 000 tons	1,306	2,111	2345
Imports, 000 tons	371	355	436
Exports, 000 tons	20	23	31
Apparent U.S. consumption 000 tons	736	940	1,774
CONSTRUCTION BOARDS[2]			
Production, 000 tons	2,195	2,706	3,020
Capacity, 000 tons[3]	1,566	1,815	1,839
Imports, 000 tons	200	231	210
Exports, 000 tons	75	107	55
Apparent U.S. consumption 000 tons	2,320	2,830	3,175

1. All tons are short tons.
2. Includes insulating and hardpressed boards; does not include wet machine boards.
3. Does not include hardpressed boards.

refrigerators, and ductwork.

Rigid insulation boards are divided into two categories—interior and sheathing. The difference is that **sheathing boards** are made water-resistant with the use of resins or asphalt, while **interior boards** are not water-resistant.

These two basic types are made into a number of special products suitable for specific construction uses and for a number of packaging and other nonconstruction applications. Specific structural insulating board products are (1) building board, (2) wallboard, (3) insulating deck board, (4) above-deck thermal insulating board, (5) ceiling tile and lay-in panels, (6) planking, (7) sheathing, and (8) shingle backing.

Hardpressed boards are of either medium density or high density. Among the wide varieties of uses for hardpressed boards are applications in making furniture, appliances, automobiles, railcars, store fixtures, and in general construction work. **Medium-density boards**, which range in density from 40-48 lb/ft^3, are used mostly in furniture and home siding. **High-density boards** range in density from 50 to 65 lb/ft^3.

Defibrated woodpulp is formed into a sheet by a wet or dry forming process to make hardboard. Of the hardboard plants currently operating in the U.S., about half use dry-forming techniques. The panels are cut to size, treated with chemicals and then high pressure is applied to the board. It is dried later if necessary. Production of hardboard is usually reported by area (square foot) at a thickness of ⅛-in. Square footage production of medium-density fiberboard is generally reported in a ¾-in. thickness.

U.S. CAPACITY FOR CONSTRUCTION PAPERS AND BOARDS

(000 short tons)

	Construction papers	Insulation boards	Hardpressed boards
1986	1,262	1,487	—
1985	1,261	1,487	—
1984	1,259	1,487	—
1983	1,258	1,487	—
1982	1,306	1,566	—
1981	2,272	1,832	—
1980	2,345	1,839	2,550e
1979	2,380	1,885	2,556e
1978	2,352	1,830	2,525e
1976	2,317	1,832	2,511
1974	2,165	1,898	2,334
1972	2,076	—	—
1970	2,042	—	—

e = Estimate.

Source: American Paper Institute.

OUTLOOK

Demand for construction grades,—which rely heavily on construction activity, particularly residential housing—was severely affected by the sharp decline in new housing starts in 1980-82. Housing starts in 1981 plunged to 1.1 million units, their lowest level since 1946, and remained depressed in 1982. In 1983, the market picked up sharply, though, rising 60% to 1.703 million housing starts, where it was expected to remain in 1984.

Analysts say housing starts for the rest of the decade will remain considerably lower than the two-million-start peak reached in the late 1970s. A survey published by Morgan Guaranty Trust Co. in May 1982 indicates housing starts will average 1.4 to 1.5 million/year for the 1982-86 period. DRI expects housing starts will not exceed 1.8 million/year during the economic recovery due to pent-up demand.

Interest rates are the single most important factor in determining the level of housing starts. When rates shot up in 1981-82, they severely depressed the market, but it began to pick up again in 1983 as interest rates declined. The housing recovery lasted for about 18

CANADIAN PRODUCTION AND CAPACITY: BUILDING PAPERS AND BOARDS

(000 short tons)

	Production		Capacity
	Building[1] papers	Building[2] boards	Building papers/ boards
1986	—	—	751
1985	—	—	750
1984	—	—	751
1983	141	294	752
1982	124	241	805
1981	118	270	805
1980	138	336	827
1979	152	377	858
1978	163	443	842
1977	157	336	796
1976	164	410	792
1975	161	374	795
1974	157	468	794
1973	163	497	776
1972	172	463	725
1971	146	427	—
1970	102	371	—

[1] Canadian classification for building papers does not necessarily represent actual production. For example, exports for building papers exceed production.

[2] Includes both insulation and hardpressed boards.

Source: Canadian Pulp & Paper Assn.

months; then it started to ebb again as interest rates began to go up in the spring of 1984. In June 1984, conventional fixed-rate mortgage interest rates averaged 14.76%, up from 13.68% in February 1984 and 12% and less at times during the previous year, according to the Federal Home Loan Bank Board.

Late in the first quarter of 1984, it became apparant that home buying and building were lagging. Sales of new single-family homes fell 4.9%, and home building permits were down to an annual rate of 1.7 million units. But contracts for future construction were at a record high in May after holding constant for the previous nine months.

Also in May, apartment starts were at a level not exceeded since the late 1970s, and contracts for manufacturing plants, commercial buildings, offices and stores continued to soar, according to government figures. Observers, while puzzled, suspected that builders were anticipating lower interest rates in one to two years, after construction has been completed.

Housing outlook. Merrill Lynch Pierce Fenner & Smith Inc. expected rates to moderate in the second and third quarters of 1984 and that most of the increases during the year would be in short-term rather than long-term loans. Industry observers felt buyers were delaying purchases until fall, when rates were expected

PROPERTIES OF WOOD-BASE BUILDING FIBERBOARDS[1]

Property	Unit	Structural insulating board	Medium-density fiberboard	High-density hardboard	Tempered hardboard	Special densified hardboard
Density	lb/ft^3	10-30	33-50	50-65	60-80	85-90
Specific gravity	1000 psi	0.16-0.42	0.53-0.80	0.80-1.28	0.93-1.28	1.36-1.44
Modulus of elasticity (bending)	psi	25-125	325-700	400-800	650-1,100	1,250
Modulus of rupture	psi	200-800	1,900-6,000	3,000-7,000	5,600-10,000	10,000-12,500
Tensile strength parallel to surface	psi	200-500	1,000-4,000	3,000-6,000	3,600-7,800	7,800
Tensile strength perpendicular to surface	psi	10-25	40-200	75-400	160-450	500
Compressive strength parallel to surface	psi	—	1,000-3,500	1,800-6,000	3,700-6,000	26,500
Shear strength (in plane of board)	psi	—	100-475	300-600	430-850	—
Shear strength (across plane of board)	psi	—	600-2,500	2,000-3,000	2,800-3,400	—
24-hour water absorption	% volume	1-10	—	—	—	—
24-hour water absorption	% weight	—	5-20	3-30	3-20	0.3-1.2
Thickness swelling, 24-hour soaking	%	—	2-10	10-25	8-15	—
Linear expansion from 50 to 90% relative humidity[2]	%	0.2-0.5	0.2-0.4	0.15-0.45	0.15-0.45	—
Thermal conductivity at mean temperature of 75°F	Btu in./h ft^2/°F	0.27-0.45	0.54-0.75	0.75-1.40	0.75-1.50	1.85

1. Data shown are general round-figure values from numerous sources; for more exact figures on a specific product, individual manufacturers should be consulted. Values are for general laboratory conditions of temperature and humidity.
2. Measurements made on material at equilibrium at each condition at room temperature.

Source: Wood handbook, Forest Products Laboratory, U.S. Department of Agriculture, No. 72, 1974 to ease because of the presidential election.

But even if borrowing becomes more affordable, the construction market will probably not be as robust during the 1980s as in the previous decade due to a trend toward smaller houses and reduced government spending for various types of projects, industry observers say.

Within the construction paper/board market, sales of roofing felt and insulation board should continue to be eroded by increasing popularity of fiberglass and rubber roofing products and fiberglass and foam insulating materials.

Roofing felt lost its dominance in the market in the last two years, according the the Dept. of Commerce figures. A government official said less than half of roofing materials in 1983 were organic.

Fiberglass roofing has made considerable headway in expanding its share of the market since 1980, when it held an 11% share. In 1981, it moved up to 20% of the market, according to the Dept. of Commerce. Industry reports, however, indicate fiberglass may have captured as much as 40% of the market by 1981.

An industry marketing executive estimates that by 1988 fiberglass will have 70% to 75% of the residential segment of the market and 40% to 50% of the commercial business.

Fiberglass mat capacity. In the past few years, a number of roofing producers have converted all or a great percentage of their capacity to fiberglass mat from organic-based roofing products. In 1981, an estimated 165,000 tpy of fourdrinier and another 60,000 tpy of dry-process glass mat capacity were added. Observers estimate that an additional 20,000 to 30,000 tpy were added by the end of 1982. Additional fiberglass capacity coming online in the next few years is expected to keep operating rates at about 70%.

Since 1980, a number of producers have also come out with new, single-ply rubber roofing systems which some analysts expect will dominate the commercial building market in a few years. In 1982, GAF Corp. entered the single-ply roofing market with an ethylene-propylene-diene monomer system.

Industry forecasters with the Dept. of Commerce expect asphalt shingles to continue to lose market share because they are more expensive and typically less durable than other types of roofing.

The roofing industry began to come out of the economic recession of 1981-82 about mid-1982 when roofing prices went up about 5% due to lower interest rates spurring construction activity. An estimated 80% of the roofing plants in the U.S. were operating during 1983, according to one industry analyst. Of those down, most were not expected to restart.

Government figures indicate 56.531 million squares

CONSTRUCTION PAPERS AND BOARDS U.S. PRICES—TRENDS

($/1,000 ft^2, year-end)[1]

	Insulation board (1/2-in.)	Hardboard (Type 11, 1/8-in.)
2nd quarter 1984	$92.45	$141.42
1983	93.01	140.85
1982	88.96	139.09
1981	86.90	133.83
1980	81.14	119.99
1979	62.09	101.76
1978	78.98	97.25
1977	70.15	89.043
1976	58.54	82.993
1975	49.98	71.177
1974	51.67	64.566
1973	49.09	65.023
1972	45.63	61.489
1971	42.63	65.099
1970	39.67	67.730

1. Average

Source: Bureau of Labor Statistics, quoted by PULP & PAPER WEEK DATABOOK 1980

MARKET INDICATORS FOR CONSTRUCTION PAPERS AND BOARDS

	Consumption[1] (000 short tons)	Value of new construction[2] (constant 1972 $ million)	New housing starts (000 units)
1984	—	122,834[3]	1,370[4]
1983	—	166,931	1,703
1982	4,455	149,287	1,062
1981	3,848	99,900	1,084
1980	4,390	103,000	1,292
1979	5,436	114,900	1,749
1978	6,090	117,358	2,023
1977	5,759	111,178	1,990
1976	5,450	104,995	1,548
1975	4,710	97,229	1,171
1974	5,331	109,132	1,352
1973	5,760	126,924	2,057
1972	5,734	123,920	2,379
1971	5,228	116,037	2,085
1970	4,418	107,009	1,469
1965	4,122	109,678	1,510
1960	3,266	62,568	1,296

1. Includes construction papers, insulation and hardpressed boards.
2. New construction put in place in constant 1972 $ million 1960-1981; 1977 dollars 1982-84.
3. First eight months 1984.
4. First nine months 1984.

of roofing were produced in 1982 compared with 54.797 million squares in 1981. A square is 100 ft², an industry basis used for determining production.

Roofing market. The roofing market has not been consistently strong since demand picked up in 1982, however. Manufacturers of cellulose-based roofing materials tried several times to raise prices in 1983 but instead suffered setbacks. The Bureau of Labor Statistics indicated asphalt roofing prices fell 7.9% in 1983. The market was strengthening in the second quarter of 1984, though, and a 7% price increase was expected to take effect in April 1984, when the operating rate was said to be 75%.

A government forecaster said a boom in housing during the early 1970s should result in increased demand for roofing materials in the next few years, when it is expected that these homes will need to be reroofed. The most likely material to benefit from this upswing, however, will be fiberglass-based roofing, he noted.

Production of insulation board has been declining since 1972, when it reached 1.5 million tons, according to the Dept. of Commerce. In 1982, it reached a low of 729,000 tons and is expected to either remain relatively flat or drop further because of continued competition from alternate building materials and changing construction practices, the government estimates.

Plastic foamboard. One of the materials which has provided the strongest competition to insulation board has been plastic foamboard. Foamboard has a core of poly-isocyanurate surfaced on both sides with aluminum foil.

The main advantage of foamboard is a higher R-value (thermal resistance) than in insulation board. A typical R-value for ½-in. foamboard is 3.6 vs 1.5 for insulating board of the same thickness. Since building authorities in the U.S. recommend a minimum R-value of 11 for side walls, which is usually obtained by using fiberglass insulation in addition to sheathing and sheetrock, the use of foamboard in place of insulation board would permit the use of a thinner layer of fiberglass insulation.

As long as the price ratio of foamboard to insulation board (3:2 in 1982 for ½-in. board) does not increase, the production of insulating board in the U.S. is expected to continue to decrease.

ESTIMATED ANNUAL CAPACITIES FOR PRODUCERS OF CONSTRUCTION PAPERS

(000 short tons)

	U.S.	Canada	Total
1. Celotex Corp.	281	—	281
2. Genstar Building Materials	190	—	190
3. GAF Corp.	166	—	166
4. Tamko Asphalt Products	137	—	137
5. Building Products of Can.	—	125	125
6. Manville Forest Prod.	123	—	123
7. CertainTeed Corp.	120	—	120
8. IKO Industries Ltd.	—	110	110
9. Georgia-Pacific Corp.	102	—	102
10. Others	140	101	241
TOTAL	1,259	336	1,595

ESTIMATED ANNUAL CAPACITIES OF HARDPRESSED BOARD COMPANIES

(000 short tons)

	U.S.	Canada	Total
1. U.S. Gypsum[1]	1,077	—	1,077
2. MacMillan Bloedel	—	834	834
3. Louisiana-Pacific Corp.	690	—	690
4. Abitibi-Price Inc.	450	—	450
5. Georgia-Pacific Corp.	230	—	230
6. Superwood Corp.	225	—	225
7. Celotex Corp.	224	—	224
8. Champion International	146	—	146
9. Weyerhaeuser Co.	139	—	139
10. Canexel Inc.[2]	—	130	130
11. Temple-Eastex Inc.	87	—	87
12. Others	268	296	564
TOTAL	4,500*	1,000*	5,500

*PULP & PAPER estimate

[1] Includes Masonite Corp., which merged with U.S. Gypsum in 1984

[2] Division of CIP Inc.

ESTIMATED ANNUAL CAPACITIES OF INSULATION BOARD COMPANIES

(000 short tons)

	U.S.	Canada	Total
1. Celotex Corp.	365	—	365
2. Boise Cascade Corp.	154	—	154
3. U.S. Gypsum Co.	130	50	180
4. National Gypsum Co.	119	—	119
5. Conwed Corp.	95	—	95
6. Manville Forest Prod.	95	—	95
7. Owens-Corning Fiberglas	81	—	81
8. Building Products of Can.	—	65	65
9. Temple-Eastex Inc.	16	—	16
10. Others	432	162	432
TOTAL	1,487	284*	1,771

* PULP & PAPER estimate

Production of hardboard in the U.S. has been static during the last decade, hovering around two million tons since 1972. In 1982—the last year for which government figures are available—production plummeted to 1.465 million tons from 1.980 million tons the year before. The downturn in housing curtailed production in 1981-82, but it is not expected to recover to any great extent even with the improvement in the construction industry. Hardboard appears to be a fairly mature construction material and no new plants have been built in the U.S. during the last decade. The industry is expected to remain static or decline in the next five years, said a government official.

First production of medium-density fiberboard began in 1966 and by 1978 production in the U.S. reached a record 539 million ft^2 before dropping to 513 billion ft^2 in 1980 (¾-in. basis), according to National Particleboard Assn. data. By 1980, MDF production amounted to nearly 17% of particleboard output, an older building material over which MDF has a number of advantages. MDF can be machine-edged, embossed, engraved and contoured and is also more profitable to make since it sells at a premium of $100 to $125/1,000 ft^2 (¾-in board) over the price of particleboard for the same use even though made from a cheaper raw material (mixed hardwoods).

MDF replacing particleboard. MDF did better than other types of fiberboard through the economic recession of 1981-82, with the 1980 operating rate for the 11 MDF plants in the U.S. average 80%. This is because the main market for MDF is furniture rather than the depressed home building market. Although the decline in new home production in the U.S. is likely eventually to affect demand for furniture, MDF will probably continue to grow because of its role as a particleboard replacement.

Cellulose insulation held an estimated 10% market share in 1981, and fiberglass sales represented about 50% of the market, according to one observer. Fiberglass is expected to continue to gain market share from cellulose insulation, which is on a decline that is not expected to reverse. In 1982, production dropped to 42.297 million bags compared with 45.959 million bags a year earlier. Fiberglass is considered to be more fire-resistant and a better insulating material than cellulose.

Cellulose insulation is made from shredded old newspapers and boric acid, as well as various other chemicals which serve as flame retardants and corrosion inhibitors. Demand for cellulose insulation has varied considerably in recent years due to numerous unrelated factors such as climate, weather, product quality, and competition from other materials, making it difficult to determine future market conditions.

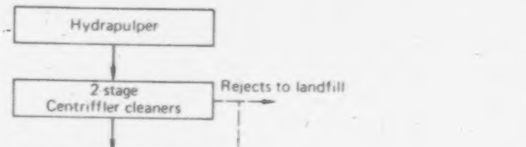
Industry observers estimate cellulose insulation demand grew by 17% in 1975, 79% in 1976 and 104% in 1977, when about 750,000 tons were shipped. Rapid expansion caused some problems, such as the production of some types of cellulose insulation that were a fire hazard. This caused production to drop in 1978 by as much as 50%, according to estimates.

In an effort to regain some of its market share, the industry improved the product, making it more flame retardant and anticorrosive, but public concern persisted. Industry capacity was estimated at 1.5 million tons early in the 1980s, but production was considerably lower and the industry was just starting to overcome its image problem when the housing market deteriorated and consumers held off nonessential home improvements, such as insulating. In addition, alternate insulation products—particularly fiberglass—continued to gain market share.

Cellulose and fiberglass, however, are aimed at different markets. Cellulose is more suited to the retrofit market, while fiberglass is used more in new home construction. Foam insulation is still the most popular product used in the reinsulation business, however. About 90% of cellulose insulation is used for insulating older homes, according to Franklin Associates Ltd.

Return of cellulose insulation. According to the

PROCESS FLOWSHEET FOR THE PRODUCTION OF ROOFING FELT



Source: PULP & PAPER, May 1975.

Insulation Institute, in 1981 there were just 235 insulation producers left of 900 that sprang into business during the 1977-78 boom period in home insulation. Cellulose insulation producers, however, have been stepping up product innovations to make them more competitive. In recent years they have developed a way to blow cellulosic insulation into walls, enabling them to compete in the retrofit market.

ESTIMATED MATERIALS USED IN MANUFACTURE OF CONSTRUCTION PAPER AND INSULATION BOARDS

(Does not include hardpressed boards)

	1977	1972	1982p
Shipments, total, 000 tons[1]	2,569.0	2,988.6	3,308.4
Pulpwood, 000 cords, 128 ft^3	1,022	1,069	n.a.
Softwood, bolts, logs	188	285	n.a.
Chips	538	418	400
Slabs, and other wastes	97.6	92.7	5.3
Hardwood, bolts, logs	94.3	140.1	—[3]
Chips, slabs, etc.	104.4	132.9	120.3
Chemical			
Caustic soda, 100% NaOH, 000 tons[1]	1.7	—[2]	1.3
Titanium dioxide, million lb	2.0	6.9	.5
Aluminum sulfate, 000 tons	7.6	—[2]	n.a.
Lime, 000 tons	1.8	—[2]	—[3]
Fiber			
Woodpulp produced & consumed at site, 000 tons[1]	1,254.8	—[3]	n.a.
Purchased woodpulp, 000 tons[1]	3.2	—[3]	n.a.
Wastepaper, 000 tons[1]	779.0	819.3	282.9
Mixed	447.9	489.6	112.0
News	117.6	181.5	70.9
Corrugated	213.5	148.2	100.0
Other materials			
Fiber, rags, straw, etc., 000 tons[1]	—[2]	345.0	n.a.
Asbestos, 000 tons	125	130.7	n.a.
Kaolin and clay, million lb	24.7	32.1	27.1
Starch, million lb.	52.9	73.4	45.1

p = Preliminary. n.a. = Not available.

[1] All tons are short tons.

[2] Data not collected.

[3] Withheld to avoid disclosure of operations from individual companies.

Source: 1977, 1982 Census of Manufactures and Bureau of the Census, MA 26A report, 1982.

The Bureau of Labor Statistics reported a 4.2% rise in cellulosic insulation prices in 1983 while the National Assn. of Home Builders' statistics reflected a 6.9% increase, although this figure represents both cellulosic and fiberglass-based insulation. Insulation manufacturers expected prices to continue to rise—though modestly—through 1984.

Gypsum wallboard was one of the last sectors of the construction paper and board market to be affected by the 1980-82 housing recession and one of the last to recover when the market picked up again. But its revitalization was sharp and long-lasting, with mills still running strong while other sectors of the industry were lagging by mid-1984.

Gypsum board manufacturers implemented several price increases in 1983. The National Assn. of Home Builders reported gypsum board prices rose 29.4% in 1983. Price increases were expected to continue through 1984. Gypsum board mills ran at 84.5% in 1983 compared with 67.9% the previous year. The operating rate is expected to exceed 86% in 1984 and top 90% in 1985.

Government forecasters expect the gypsum wallboard market to grow by 3.5%-4% over the next few years, taking some market share from paneling products because of gypsum's lower price and adaptability. Consumption of gypsum wallboard increased in 1983 to 16.818 million ft^2 from 13.086 million ft^2 in 1982. In 1984, it was expected to reach about 19 million ft^2. The most promising future market will be in mobile homes, which consumed four times more gypsum board in 1983 than in the previous year.

WASTEPAPER USE

In the fiber furnish for construction papers and boards, the following proportions of wastepaper were used in 1982, according to the American Paper Institute: 431,000 tons (40.85%) mixed papers, 206,000 tons (19.53%) old news, 312,000 tons (29.57%) old corrugated containers, 84,000 tons (7.96%) pulp substitutes, 23,000 tons (2.18%) high-grade deinking.

According to API's capacity survey, the use of wastepaper in construction paper and board is expected to rise modestly from 1.086 million tons in 1983 to 1.131 million tons in 1984, 1.172 million tons in 1985 and 1.182 million tons in 1986.

MARKET PULP

Market pulp is defined as woodpulp produced for sale in open competition with pulp from other producers. It excludes tonnage intended for consumption in the producing mill or for shipment to any mill in Canada or the U.S. which is owned by, controlled by or affiliated with the producing mill.

There are two basic types of market pulps: (1) dissolving or special alpha pulps and (2) paper-grade pulps. Dissolving and special alpha pulps have a high alpha (pure cellulose) content and are used to make rayon, acetate and other cellulose derivatives as well as specialty papers. Most paper-grade market pulps are produced by chemical processes although some are made by mechanical methods, such as stone groundwood and thermomechanical pulping.

Chemical paper pulps are further divided into grades based on whether they are made from softwood or hardwood, northern or southern fiber, sulfate (kraft) or sulfite pulping processes, and whether they are bleached, semibleached or unbleached. Fluff pulp goes into nonpaper applications, such as baby diapers, but is included in paper-grade pulp for statistical purposes. Most paper-grade market pulp is cut into sheets and sold in bale form, but some is sold in rolls and a small amount is flash-dried and baled.

Integrated paper mills can sell captive pulp on the open market when internal pulp demand is low. When pulp demand is high, market pulp mills may shift tonnage to affiliated paper mills. Dissolving pulp mills can normally produce either chemical cellulose or paper-grade pulps. As a result, market pulp capacity ratings are inexact and vary with market conditions.

CHEMICAL PAPER-GRADE MARKET PULPS

North American market **sulfite pulp** production in 1950 exceeded sulfate production, and for many years sulfite pulps were considered the most desirable type for papermaking. But by 1983 production in the U.S. and Canada of bleached and unbleached sulfite market pulp had dropped to only 440,000 metric tons and accounted for only about 4% of total North American chemical paper-grade market pulp production.

This trend is expected to continue gradually, with the shutdown of small, older mills and with few new sulfite pulp mills being built (one exception is Fraser Inc.'s expansion of its Atholville, N.B., sulfite mill). The same declining trend has taken place in Scandinavia, where sulfite now accounts for about 13% of chemical paper-grade market pulp capacity.

Most North American sulfite pulp is produced from northern and eastern softwoods (spruce, pines, firs, and hemlocks). One sulfite mill in the U.S. South (ITT Rayonier Inc. at Fernandina Beach, Fla.) produces paper-grade and dissolving pulp grades from southern pine. A few U.S. and Canadian mills produce sulfite pulp from hardwoods. Sulfite pulps are still highly desirable for producing high-quality tissue and printing/writing papers.

STATISTICS FOR MARKET PULP[1]

	1982	1983	1984e
UNITED STATES			
Production, 000 tons	4,213	4,694	4,970
Annual capacity, 000 tons	4,961	5,085	5,133
Utilization rate, %	84.9	92.3	96.8
Apparent consumption, 000 tons	3,972	4,672	5,140
Imports, 000 tons	1,998	2,448	2,750
Exports, 000 tons	2,239	2,470	2,580
CANADA			
Production, 000 tons	5,284	6,071	6,200
Annual capacity, 000 tons	6,840	7,022	7,094
Utilization rate, %	77.3	86.5	87.4

e = Estimate.

[1] All tonnage is in metric tons (2,205 lb or 1.1023 short tons)

Source: American Paper Institute, Canadian Pulp & Paper Assn., Dept. of Commerce Data.

Bleached sulfate (kraft) has become the predominant grade of market pulp, with Canadian and U.S. production in 1983 totaling 10.0 million metric tons (including semibleached pulp). The largest percentage of production is made from softwood fibers such as spruce, fir, and pine. Bleached kraft softwood output totaled 4.95 million tons in Canada and 2.7 million tons in the U.S. in 1983. The most preferred softwood pulps are generally considered to be those from mills in western Canada, the U.S. Pacific Northwest and northeastern Canada and the U.S.

Southern pine pulps are somewhat lower in quality as the fiber is coarser and produces a poorer sheet for printing/writing grades. But as more Southern pine pulp has become available, papermakers have learned how to use increasing amounts in most white paper grades. Nevertheless, southern pine pulps normally sell at about a $25/metric ton discount from premium northern bleached softwood kraft (NBSK) pulp and in weak markets the differential may be larger.

Bleached hardwood sulfate market pulps are produced in the U.S. Northeast and South, with a small amount also produced in eastern Canada. Hardwood accounts for about 35% of U.S. and 11% of Canadian bleached sulfate market pulp production. Canadian hardwood normally sells at about a $20/metric ton premium to southern U.S. hardwood, with U.S. northern hardwood producers—which must compete more with southern mills—usually in the middle of the price spectrum.

Southern hardwood pulps are normally sold as mixed hardwoods, with or without oak. Oak and some other species high in vessels have caused excess picking on offset printing grades. However, papermakers in the last 20 years have reduced the picking tendency of oak-containing pulps so that these problems are not too serious for printers.

The hardwood pulps, blended with or without softwood pulps, make an excellent printing/writing grade, providing bulk and a good printing surface. Hardwood kraft market pulps are generally sold at $25 to $30/ton discount from softwood kraft grades produced in the same region.

Unbleached kraft market pulp production has been declining in North America and currently accounts for only about 3% of North American chemical paper-grade market pulp production. About 40% of unbleached kraft market pulp in the U.S. has been used in one-time carbonizing tissue, a market which has been shrinking due to inroads by carbonless copy paper. Other end uses for unbleached kraft market pulp have been in filter papers, cable wrap, condenser papers, twisting grades and other specialties.

Small nonintegrated mills in developing countries

U.S. PRODUCTION OF MARKET WOODPULP

(000 metric tons)

Year	Total all grades	Dissolving and special alpha	Bl. & unbl. sulfite	Total bl. & semibl. sulfate*	Bl. & semibl. softwood sulfate	Bl. & semibl. harwood sulfate	Unbl. sulfate
1983	5,857	1,163	226	4,342	2,666	1,676	126
1982	5,200	988	187	3,914	2,558	1,356	111
1981	5,626	1,224	241	4,030	2,559	1,471	131
1980	5,865	1,366	345	3,971	2,480	1,491	119
1979	5,151	1,360	250	3,381	2,084	1,298	102
1978	4,647	1,273	227	2,985	1,785	1,200	68
1977	4,358	1,327	211	2,626	1,673	953	124
1976	4,413	1,243	287	2,721	1,659	1,062	102
1975	3,953	1,118	292	2,423	1,777†	891†	79
1974	4,663	1,461	360	2,635	1,428†	1,093†	173
1973	4,468	1,356	441	2,552	1,384†	1,040†	100
1972	4,559	1,519	436	2,454	1,300†	1,023†	106
1071	4,204	1,524	378	2,109	1,096†	842†	200
1970	4,491	1,555	534	2,487	1,190†	1,075†	386
1965	3,486	1,347	563	1,298	n.a.	n.a.	214
1960	2,717	1,019	526	897	n.a.	n.a.	262
1955	2,429	880	551	767	n.a.	n.a.	204
1950	1,454	428	604	261	n.a.	n.a.	113

* Includes soda pulp.
† Excludes semibleached.
n.a. = Not available.

Source: American Paper Institute.

U.S. MARKET WOODPULP CAPACITY

(000 short tons)

Year	Total all grades	Dissolving	Total paper grades	Bleached sulfate[1]	Unbleached sulfate	Sulfite	Others
1986e	7,954	1,594	6,346	5,926	143	277	14
1985	7,787	1,594	6,179	5,760	143	277	14
1984	7,266	1,594	5,658	5,238	143	277	14
1983	7,212	1,594	5,605	5,185	143	277	14
1982	7,079	1,598	5,496	5,040	142	288	12
1981	6,972	1,579	5,375	4,867	167	342	17
1980	6,801	1,576	5,129	4,589	172	369	96
1979	6,344	1,551	4,682	4,228	104	350	101
1978	5,746	1,573	4,069	3,653	107	309	104
1977	5,467	1,611	3,856	3,280	164	301	111
1976	5,407	1,421	3,986	3,194	218	459	116
1975	5,412	1,488	3,924	3,218	212	460	34
1974	5,557	1,636	3,921	3,240	191	471	19
1973	5,365	1,590	3,775	3,102	148	505	20
1972	5,412	1,720	3,692	3,058	137	497	—
1971[2]	4,958	1,760	3,198	2,482	240	476	—

e = Estimate.

[1] Includes semibleached.

[2] First year in which market pulp capacity was reported by API.

Source: American Paper Institute.

MACHINE-DRIED WOODPULP CAPACITY

(000 short tons)

Year	Total	Dissolving	Bleached sulfite	Bleached sulfate	Unbleached sulfate	Other
1986e	10,268	1,604	416	8,012	145	109
1985e	10,167	1,604	416	7,803	145	109
1984e	9,630	1,604	416	7,357	145	109
1983	9,500	1,604	416	7,226	145	109
1982	9,497	1,606	448	7,188	151	104
1981	9,328	1,598	496	6,935	190	108
1980	9,156	1,590	520	6,671	189	187
1979	8,575	1,536	536	6,200	109	194
1978	8,192	1,573	569	5,737	118	194
1977	7,975	1,648	638	5,311	178	200
1976	7,904	1,571	787	5,117	226	202
1975	7,900	1,671	782	5,079	239	131
1974	7,975	1,824	816	5,021	213	102
1973	7,710	1,759	803	4,841	211	97
1972	7,503	1,756	782	4,702	249	11
1971	7,404	1,769	761	4,600	270	4
1970	7,247	1,768	832	4,384	261	1

e = Estimate.

Source: American Paper Institute.

still use unbleached kraft market pulp to produce commodity paper and paperboard grades. This should cause export demand for unbleached kraft market pulp to grow, although North American mills face competition in these markets from producers in such countries as Chile, New Zealand and Swaziland.

NORTH AMERICAN INDUSTRY STRUCTURE

The U.S. pulp and paper industry is highly integrated and market pulp accounts for only a small percentage of total woodpulp production or consumption.

Of the 81 U.S. companies that produce paper-grade market pulp, only 32 sold any pulp in 1983, according to Ronald J. Slinn, vice president of the American Paper Institute's Pulp Materials & Technology Group. Many of the 256 companies in the U.S. paper industry also buy significant quantities of pulp, but at least 175 must purchase all of the fiber they require, including wastepaper.

In 1983, the U.S. paper industry produced 46.5 million metric tons of chemical paper-grade pulp, of which 85% was consumed on site, 5% was shipped to affiliated mills within the U.S., 5% was shipped to the domestic market and 5% was exported, according to API. Apparent U.S. paper-grade woodpulp consumption in 1983 totaled 47.6 million tons, of which 83% was supplied from integrated sources within the U.S., 5% was derived from U.S. affiliates, 5% from the domestic market and 7% from imports.

U.S. imports in 1983 totaled 3.5 million tons, of which 93% was supplied by Canadian producers. The remaining 7% came from Scandinavia, Brazil and South Africa. Canadian paper-grade pulp shipments to the U.S. in 1983 were 3.3 million metric tons, of which 28% consisted of "tied" shipments from Canadian affiliates of U.S. paper companies.

In contrast to the U.S., market pulp accounts for a large share of total Canadian chemical paper-grade woodpulp production, which totaled about 10.9 million metric tons in 1983. Of this, 35% was consumed on site or by affiliated mills, 6% was shipped as market pulp to domestic mills, 28% was shipped to the U.S. (including roughly 925,000 tons of "tied pulp") and 30% was exported abroad, according to Canadian Pulp & Paper Assn. data. About 32 companies in Canada sold chemical paper-grade market pulp in 1983.

Paper-grade market pulp is used principally in three paper grades in the U.S.: (1) uncoated free-sheet; (2) coated printing and publication papers; and (3) tissue. The remainder is used in such grades as packaging and industrial converting grades, bristols and bleached board.

As a result, U.S. demand for market pulp is closely

SOURCES OF U.S. WOODPULP SUPPLY

(000 metric tons)

	U.S. pulp[1] production		Imports from Canada		Imports from other countries		
	Tonnage	%	Tonnage	%	Tonnage	%	Total
1983	47,661[2]	92.7	3,407	6.6	306[3]	0.6	51,374
1982	44,754[2]	93.1	3,051	6.3	264	0.5	48,069
1981	47,211[2]	92.7	3,448	6.8	260	0.5	50,919
1980	46,189	92.6	3,494	7.0	180	0.4	49,863
1979	45,914	92.1	3,745	7.5	169	0.4	49,828
1978	45,792	92.6	3,497	7.1	149	0.3	49,438
1977	44,482	92.7	3,338	7.0	168	0.3	47,988
1976	43,020	92.9	3,246	6.8	135	0.3	46,401
1975	39,234	93.4	2,713	6.5	78	0.2	42,024
1974	43,862	92.1	3,597	7.6	143	0.3	47,602
1973	43,842	92.4	3,456	7.3	166	0.3	47,464
1972	42,427	92.6	3,270	7.1	116	0.3	45,813
1971	39,829	92.6	3,071	7.1	118	0.3	43,018
1970	39,505	92.5	3,057	7.2	134	0.3	42,696
1965	30,838	91.6	2,558	7.6	288	0.8	33,684
1960	22,966[2]	91.4	1,843	7.3	317	1.3	25,126
1955	18,815[2]	90.4	1,692	8.1	316	1.5	20,823
1950	13,471[2]	86.2	1,558	10.0	606	3.9	15,635

1. Total woodpulp production, including dissolving pulps, defibrated pulps and screenings.
2. American Paper Institute data.
3. Includes 157,000 tons from Brazil, 68,000 from Sweden.

Source: U.S. Dept. of Commerce and American Paper Institute.

related to the level of U.S. paper production, particularly the printing/writing grades. When U.S. printing/writing paper mill operating rates exceed the low 90% range, the amount of white market pulp consumed in relation to total white pulp usually has risen above 20% in recent years (see accompanying table). If paper production is below 90%, however, the ratio of market to total paper pulp consumption has often dropped into the 18% to 19% range (see accompanying table). White pulp includes bleached and semibleached kraft and bleached and unbleached sulfite.

The shift in this ratio can cause dramatic changes in U.S. market pulp consumption. In the 1983 recovery, for example, white paper production rose 11.4%, with mill operating rates climbing to 95.3% from 87.7% in 1982. Total U.S. white pulp apparent consumption rose 7.6%, but white market pulp consumption jumped 18.3%.

The main reason for this swing is that many integrated companies must supplement their own pulp supplies when running at full capacity by purchasing fiber on the open market. At the same time, the available supply of market pulp may contract as paper production levels rise and companies first try to meet their own integrated requirements. Thus, unlike most commodities, the supply of market pulp tends to decline as demand rises—a factor that no doubt contributes to market pulp's cyclicality.

INTERNATIONAL MARKET

The pulp market is international in nature, with large volumes of pulp moving duty-free between net producing regions and net consuming regions. North America and Scandinavia have been the largest market pulp producing regions, although nontraditional supplying countries such as Brazil have been growing in importance.

Norscan pulp shipments of chemical paper-grade market pulp in 1983 reached a new peak of 16.0 million metric tons, with shipments from Canada at 6.2 million tons, the U.S. at 4.7 million tons, and Scandinavia at 5.1 million tons. Shipments from non-Norscan supplying countries totaled 6.4 million tons, bringing world shipments (excluding eastern Europe and China) to

U.S. MARKET PULP MILLS—SUMMARY OF STATISTICS

	All establishments		Employees					
Year[1]	Total (number)	With 20+ employees (number)	Number (000)	Payroll (million $)	Value added by manufacture (million $)	Cost of materials (million $)	Value of shipments (million $)	New capital expenditures (million$)
1982 Census	43	41	16.7	467.9	n.a.	1,986.5	3,129.0	658.6
1981 AMS	n.a.	n.a.	15.9	408.1	1,221.7	1,960.1	3,141.8	521.5
1980 ASM	n.a.	n.a.	16.2	404.6	1,292.7	1,776.9	3,031.9	258.8
1979 ASM	n.a.	n.a.	15.7	338.9	1,117.2	1,417.2	2,544.1	239.7
1978 ASM	n.a.	n.a.	15.1	306.3	855.5	1,268.0	2,152.4	194.6
1977 Census	45	42	16.2	293.2	885.7	1,212.4	2,071.1	301.1
1976 ASM	n.a.	n.a.	15.7	260.5	974.6	1,087.7	2,055.4	375.0
1975 ASM	n.a.	n.a.	13.1	191.4	821.0	837.0	1,630.4	294.2
1974 ASM	n.a.	n.a.	12.0	163.2	779.3	766.1	1,525.2	135.6
1973 ASM	n.a.	n.a.	10.8	138.2	382.7	464.0	848.5	118.7
1972 Census	60	35	10.6	125.7	306.9	388.1	709.9	136.4
1971 ASM	n.a.	n.a.	14.5	156.3	367.2	496.4	841.8	135.2
1970 ASM	n.a.	n.a.	15.6	160.2	466.3	508.3	960.3	121.6
1969 ASM	n.a.	n.a.	14.9	142.6	362.0	455.2	820.0	132.6
1968 ASM	n.a.	n.a.	15.4	136.0	361.3	431.2	799.3	77.0
1967 Census	61	43	15.1	125.6	333.7	403.2	730.5	121.8
1966 ASM	n.a.	n.a.	14.8	112.3	346.1	320.1	658.5	113.3
1965 ASM	n.a.	n.a.	14.8	112.3	346.1	320.1	758.5	112.2
1964 ASM	n.a.	n.a.	15.3	113.6	331.6	328.6	662.8	66.6
1963 Census	45	40	15.1	107.4	295.8	312.6	609.1	38.9

n.a. = Not available.

[1] In years of Annual Survey of Manufactures (ASM), data are estimates based on a representative sample of establishments canvassed annually and may differ from results of a complete canvass of all establishments.

Source: 1982 Census of Manufactures.

27.3 million tons. Shipments from Brazil – the most important nontraditional supplier – totaled about 1.2 million tons in 1983.

Since 1978, the share of world shipments from the Norscan countries has declined from 79.8% in 1978 to 71.2% in 1983, while the share held by non-Norscan countries has increased from 20.2% to 28.8%. White pulp accounts for about 97% of Norscan and 64% of nontraditional chemical paper-grade market pulp production capacity.

Western Europe (excluding Scandinavia) remains the largest consuming region for chemical paper-grade market pulp, with a 1983 demand of 9.1 million tons (41% of world shipments). This excludes an estimated 250,000 tons of pulp shipped to western Europe by the Soviet Union last year. The U.S. was the second largest market, consuming 4.7 million tons (21.2% of world shipments), while Japan was the third largest market with demand of 2.3 million tons (10.2% of world shipments).

China has emerged as a major market pulp buyer, taking nearly 600,000 tons of Norscan shipments in 1983. Asian and African countries (excluding China) consumed nearly 2.4 million tons of market pulp in 1983, up from 1.78 million tons in 1982 and 975,000 tons in 1981.

PULP MARKET CYCLES

North American and Scandinavian producer inventories of chemical paper-grade market pulp are a closely watched statistical barometer. There has been a curiously consistent two-year-and-nine-month time lag between the peaks and troughs in inventory levels, Wilf Silon and other analysts have pointed out. The average length of four complete market cycles (from peak to peak or trough-to-trough) since the beginning of the 1970s has been slightly more than five years.

The interest in this statistical barometer is more than academic since pulp mill inventories have tended to correlate inversely with pulp prices (see accompanying graph). Historically, two factors must be present for pulp prices to rise, according to William D. Vaughan, vice president, marketing planning and development, BC Timber Ltd. Shipment-to-capacity ratio must be at least 97% on a rising trend in demand, and Norscan inventories must fall to 1.5 million tons or below and be on a downward trend. If shipment ratios go below that

RELATIONSHIP OF PRINTING/WRITING PAPER PRODUCTION LEVELS TO MARKET PULP CONSUMPTION

(000 metric tons)

	Printing/ writing paper production	Printing/ writing paper mill operating rates	Total white pulp apparent consumption	Market white pulp apparent consumption	Market as a percent of total white pulp consumption
1983	17,387	92.2%	21,979	6,926	31.5%
1982	15,811	87.7	20,204	5,816	28.8
1981	16,722	90.8	20,464	6,271	30.6
1980	16,377	92.7	19,804	6,201	31.3
1979	16,354	93.6	19,776	6,260	31.7
1978	14,908	93.8	18,816	5,852	31.1
1977	13,897	92.8	18,098	5,150	28.5
1976	13,251	91.6	17,850	5,069	28.4
1975	11,512	77.1	15,617	3,881	24.9
1974	13,485	92.4	17,792	5,098	28.7
1973	13,405	96.3	17,950	5,054	28.2
1972	12,297	94.3	16,125	4,487	27.8
1971	11,181	88.6	15,156	4,044	26.7
1970	10,958	88.7	14,930	4,046	27.1
1969	11,188	91.8	14,877	4,460	30.0
1968	10,338	90.3	14,006	3,944	28.2
1967	10,127	90.3	13,248	3,723	28.1
1966	10,323	96.3	13,886	3,970	28.6

Source: American Paper Institute

level in a declining trend and inventories exceed 1.2 million tons, pulp prices tend to flatten out or weaken.

Pulp market cycles tend to lag behind overall economic activity. In the U.S., there has generally been about a two- to three-year lag between turning points in the economy and changes in pulp prices.

Another important factor in the current pulp market cycle has been the impact of foreign exchange rates, since most pulp is sold in U.S. dollars. From 1980 through mid-1984, currencies of most major pulp producing and buying countries have fallen sharply against the dollar. The Swedish krona has dropped 49%, the Finnish markka 38% and the Canadian dollar 10% from their average levels for all of 1980. The currencies of most major buying countries have shown a similar trend, with the West German D-mark declining 37%, the British pound 43%, the Italian lira 79%, and the French franc 79%. The Japanese yen has declined a more moderate 9%, although it was off 12% from 1978, its recent peak year against the dollar.

These sharp exchange rate fluctuations have had the effect of raising the price of pulp in local buyer currencies and increasing the cost competitiveness of non-U.S. producers. The price of benchmark northern bleached softwood kraft (NBSK) reached a peak in U.S. dollars of $540/metric ton in northern Europe in 1980 before plunging in 1982 and dropping to as low as $410 in early 1983. Since then the price has struggled back close to its previous peak, reaching $540 in the second quarter of 1984—for almost no change over this period.

The price of NBSK, however, has risen sharply in major European buyer currencies—for example, up 56% in D-marks and 106% in French francs. The return on dollar pulp sales has also risen sharply in major producer currencies—for example, up 95% in krona for producers in Sweden (which had a major devaluation in late 1982).

Currency devaluations, however, usually spur domestic inflation as a country's exports accelerate and its import prices rise sharply. An analysis by Ross Hay-Roe in his *PaperTree Letter* found that domestic inflation in most European pulp buying countries has exceeded the rise in pulp prices over a seven-year period (1977-84). Inflation rates (and hence manufacturing costs) have also risen faster than pulp prices for most of the North American and Scandinavian (Norscan) producing countries. The major exception was Sweden, which had improved its competitive cost position through the steady drop in its currency combined with a moderate inflation rate.

Swedish producers have used this competitive advantage to gain market share in both their traditional western Europe markets and in new markets such as Asia and Africa. Sweden's share of total Norscan market pulp shipments to the world market has risen from 18% in 1982 to 22% in 1983 and rose to 22% in the first half of 1984. In western Europe, Sweden's share has risen from a low of 28% to 29% several years

U.S. EXPORT TRENDS FOR WOODPULP

(000 short tons)

	Total all grades	Dissolving and special alpha	Sulfite Bl.	Sulfite Unbl.	Sulfate Bl.	Sulfate Semibl.	Sulfate Unbl.	Other
1983	3,644	647	281	12	2,510	57	96	39
1982	3,395	631	209	8	2,358	62	99	27
1981	3,678	784	272	12	2,419	66	101	61
1980	3,806	769	322	26	2,403	92	113	76
1979	2,784	862	219	38	1,632	107	104	52
1978	2,588	757	190	20	1,400	93	76	62
1977	2,640	796	192	8	1,294	164	104	81
1976	2,518	730	181	12	1,301	105	113	74
1975	2,564	692	246	22	1,337	129	96	41
1974	2,802	787	286	25	1,442	89	156	17
1973	2,344	736	293	6	1,105	126	72	5
1972	2,252	793	225	2	1,024	127	77	3
1971	2,175	790	203	10	867	146	150	9
1970	3,095	868	359	34	1,321	264	253	12
1969	2,103	744	251	13	897	152	127	8
1968	1,918	671	227	8	638	210	148	12
1967	1,720	607	241	13	519	198	132	10
1966	1,547	563	219	27	481	139	109	10
1965	1,402	535	202	38	363	139	119	6

Source: U.S. Dept. of Commerce

ago to 32% to 33% in the second half of 1983. In the first half of 1984, Sweden's share rose to nearly 40% due to the B.C. strike.

Pulp pricing in Europe may undergo major changes if pulp producers accept a plan proposed by the European Economic Community to settle an EEC pulp price-fixing case involving 57 producers worldwide, including 17 in the U.S. and 6 in Canada. Under the proposal, integrated companies which sell both pulp and paper in the EEC would have to price both commodities in the same currency. Nonintegrated producers which sell only pulp in Europe would be able to sell in the currency of either the buyer or the seller. The proposal is apparently designed to satisfy complaints by papermakers on the Continent that their profit margins are "scissored" between expensive dollar-priced pulp and increasing imports of paper from Scandinavia priced in soft currencies.

The EEC Commission said it expected the proposal to "eliminate the artificial transparency of the market." Producers from U.S., Canada, Sweden and Finland in early 1983 submitted a proposal for resolving the EEC complaint, which was rejected by the commission. A U.S. Federal Trade Commission investigation which was prompted by the EEC complaint and filed in September 1981 has been abandoned, however.

Any move to price pulp in producer or buyer currencies will make pulp marketing more difficult. And the appeal of such local currency pricing for papermakers on the Continent will probably diminish if the U.S. dollar begins to weaken.

CURRENT MARKET CONDITIONS

Chemical paper-grade market pulp demand began to weaken in 1981, with Norscan inventories climbing above the 1.2 million level late in the year. Increasing discounting pressure caused pulp prices to break in the second quarter of 1982, with the price for benchmark NBSK tumbling from $545/metric ton to around $410 c.i.f. northern Europe by the first quarter of 1983. Less preferred southern pine, hardwood and sulfite pulp grades have shown even sharper price declines.

Norscan producer inventories hit a peak of 1.92 million tons on cue in August 1982—exactly two years and nine months from their previous low of 616,000 tons at the end of 1979. The new peak, however, was down considerably from the last peak of 2.92 million tons in February 1977, when Scandinavian governments subsidized pulp stock building to maintain employment levels. Norscan shipments in 1982 plunged to 13.4 million tons, down 14.9% from their 1980 peak of 15.8 million metric tons.

Shipments came back strongly in 1983, surging 19.3% to set a new record of 15.9 million tons. Producer inventories, however, came down slowly in 1983 and

CANADIAN PRODUCTION OF MARKET WOODPULP BY GRADES

(000 metric tons)

	All grades	Dissolving & special alpha	Sulfite bl.	Sulfite unbl.	Sulfate & soda bleached & semibl.	Sulfate unbl.	Mechanical
1983	6,506e	215	186	29	5,679	177	200e
1982	5,676	219	160	47	4,894	184	171
1981	6,540	275	266	72	5,514	230	183
1980	7,156	313	271	90	6,005	242	235
1979	6,619	367	275	83	5,407	253	234
1978	6,132	334	262	75	5,037	215	209
1977	5,903	269	327	52	4,709	296	250
1976	5,954	254	368	81	4,703	287	261
1975	4,889	228	315	67	3,778	279	221
1974	6,286	351	356	156	4,746	405	272
1973	5,743	251	265	83	4,421	449	274
1972	5,021	253	282	83	3,384	328	241
1971	4,620	288	310	113	3,416	273	220
1970	4,857	326	389	187	3,379	297	279
1965	3,169	306	519	265	1,570	209	300
1960	1,908	198	309	166	771	222	242
1955	1,876	324	361	322	383	205	281
1950	1,356	293	232	339	142	193	159

e — Estimate

Source: Canadian Pulp & Paper Assn.

CANADIAN MARKET PULP CAPACITY

(000 metric tons)

	Total	Dissolving & special alpha	Sulfite bleached	Sulfite unbleached	Sulfate bleached softwood	Sulfate semibl.	Sulfate bleached hardwood	Sulfate unbl.	Mechanical
1986e	7,925	227	327	62	5,399	441	717	225	527
1985e	7,826	222	325	62	5,257	443	765	225	527
1984e	7,835	214	309	45	5,275	446	799	220	527
1983	7,641	201	306	72	5,203	453	780	208	418
1982	7,617	305	286	83	5,128	438	669	236	472
1981	7,430	303	313	84	5,056	433	634	290	317
1980	7,237	307	265	95	4,905	550	605	270	240
1979*	7,112	395	257	106	4,733	524	579	253	265
1978	7,381	424	354	187	4,739	537	590	297	253
1977	7,273	353	425	200	4,514	586	565	370	260
1976	7,224	408	527	202	4,306	562	621	339	259
1975	7,156	427	541	194	4,164	627	613	329	261
1974	6,955	404	472	192	3,976	742	594	354	221
1973	6,502	416	358	149	3,693	664	666	362	194

e = Estimate.

* Not comparable with previous years' data due to change in method for estimating capacity.

Source: Canadian Pulp & Paper Assn.

CANADIAN EXPORTS OF WOODPULP[1]

(000 metric tons)

	All grades	Dissolving & special alpha	Sulfite bl.	Sulfite unbl.	Sulfate bleached hardwood	Sulfate bl. softwood	Sulfate semi-bl.	Sulfate unbl.	Mechanical
1983p	6,823	170	283	50	477	4,981	340	166	314
1982	6,099	174	295	101	359	4,375	290	230	272
1981	6,744	221	424	86	429	4,627	399	281	270
1980	7,248	235	396	108	409	5,095	484	210	311
1979	7,090	241	482	104	341	4,929	429	248	317
1978	6,638	210	509	83	350	4,562	390	243	291
1977	6,092	130	564	81	341	4,032	372	295	276
1976	6,116	147	515	92	341	4,074	399	262	286
1975	5,001	125	414	82	285	3,271	294	331	189
1974	6,438	243	532	141	306	4,117	456	373	262
1973	5,939	208	385	107	381	3,677	471	448	253
1972	5,536	283	369	100	411	3,244	494	377	249
1971	5,149	316	387	115	392	2,893	482	342	210
1970	5,063	302	440	162	345	2,753	467	328	251
1965	3,495	349	570	239	1,501		202	333	284
1960	2,360	220	394	154	889		127	314	213
1955	2,146	299	415	337	608[2]		n.a.	201	238
1950	1,675	263	243	374	356[2]		n.a.	172	225

p = Preliminary.

1. Includes some pulp shipped to mills in the U.S. that have the same ownership. Such "tied" pulp is not included in market pulp shipments. About 925,000 tons of tied pulp was shipped to the U.S. in 1983.
2. Includes semibleached sulfate.

Source: Statistics Canada.

hovered between 1.4 and 1.6 million tons for most of the year. Pulp pricing was soft through most of 1983, with a $440 list price for NBSK announced for the second quarter of 1983 in Europe still not fully in effect by year-end.

The strong shipment surge in 1983 partly reflected customer inventory building in anticipation of a possible labor disruption in British Columbia and price increases in early 1984. These fears proved to be well founded. A nine-week labor dispute began Feb. 2 in B.C. causing an estimated potential production loss of 9,500 metric tpd. With about 20% of total Norscan capacity idled, the supply/demand balance in the world pulp market began to shift dramatically.

Producer inventories began to drop sharply—falling to nearly 907,000 tons at the end of March—and prices began to climb sharply. A $50/ton price increase announced for Jan. 1, which had originally seemed uncertain, was firmly in place by the end of the first quarter. Prices then went up another $50 on April 1, bringing NBSK to $540/metric ton—almost equal to the 1980-81 pre-recession peak of $545/ton. Other major bleached kraft pulp grades showed similar increases with new list prices in Europe rising to $520 for southern pine, $510 for Scandinavian birch, $500 for Brazilian eucalyptus and $495 for U.S. southern mixed hardwood.

The main reason for the dramatic increase in pulp prices, however, was the B.C. labor dispute, which ended in the first week of April after an estimated production loss of 600,000 tons. By the summer of 1984, the pulp market was experiencing difficulty digesting the more than $100/ton runup in pulp prices in the first half. Demand softened as customers worked down inventories they had built up during the strike and moderate price discounting spread through major world markets. One form this discounting took in Europe was increased sales of pulp in producer or buyer currencies at prices below the equivalent dollar list level.

The price discounting, together with the continuing strength of the dollar and a bulge of new capacity entering the market, made chances for a fourth quarter 1984 pulp price increase appear uncertain. New capacity coming on stream in the second half of 1984 includes Leaf River Forest Products' 335,000-tpy bleached kraft mill in New Augusta, Miss., and International Paper Inc.'s 320,000-tpy bleached kraft line at Georgetown, S.C. (Some capacity at IP's Texarkana, Texas, mill, however, will be shifted to bleached board, resulting in a net total capacity increase of around 225,000 tpy.)

In Europe, Soporcel (Sociedade Portuguesa do Celulose SARL) began production at a new 300,000-tpy bleached kraft eucalyptus pulp mill in Portugal around mid-1984, which was to be followed by the startup of Pölser Zellulose- und Papierfabrik AG's new bleached sulfite pulp mill at Pöls, Austria, with a net capacity of about 125,000 tpy. A 200,000-tpy bleached sulfite market pulp mill also started up earlier in the year at Paskov, Czechoslovakia.

COMPARATIVE PRODUCTION COSTS

The sharp rise of the U.S. dollar since 1980 has had a dramatic impact on comparative cost relationships among the market pulp producing regions of the world.

NORTH AMERICAN PAPER-GRADE CHEMICAL MARKET PULP PRODUCTION, CAPACITY, OPERATING RATES

(000 metric tons)

	United States			Canada		
	Production	Capacity	Operating rate	Production	Capacity	Operating rate
1983	4,694	5,085	92.3%	6,071	7,022	86.5%
1982	4,213	4,961	84.9	5,284	6,840	77.3
1981	4,390	4,897	89.7	6,081	6,810	89.3
1980	4,437	4,653	95.3	6,609	6,690	98.8
1979	3,733	4,202	87.8	6,018	6,452*	93.3
1978	3,300	3,691	89.4	5,589	6,704	83.4
1977	2,961	3,498	84.6	5,351	6,660	80.3
1976	3,110	3,616	86.0	5,439	6,557	82.9
1975	2,794	3,560	78.5	4,440	6,468	68.6
1974	3,166	3,557	89.0	5,663	6,330	89.5
1973	3,090	3,424	90.2	5,218	5,892	88.6
1972	2,996	3,349	89.5	4,527	5,465	82.8

* Based on new method for computing market pulp capacity, so earlier years not comparable. Former method was found to overstate actual capacity, resulting in unrealistically low operating rates.

CHEMICAL PAPER-GRADE MARKET PULP CAPACITY OF MAJOR NORTH AMERICAN PRODUCERS

	Annual capacity* (000 metric tons)			
	U.S.	Canada	Total	Capacity share (%)
1. Weyerhaeuser[1,2,3,5,6]	510	390	900	7.3%
2. International Paper[1,2,6]**	620	—	620[a]	5.1
3. Georgia-Pacific[1,2,5]	700	—	700	5.7
4. Parsons & Whittemore[1,2]	350	230	580	4.7
5. Great Lakes Forest Products[1,2,3]	—	575	575	4.7
6. Westar Timber[1,3]	—	570	570	4.7
7. Canadian Forest Products[1,3,4]	—	565	565	4.6
8. B.C. Forest Products[1,3,4]	—	480	480	3.9
9. MacMillan Bloedel[1,3,4]	—	460	460	3.8
10. Leaf River Forest Products[1,2,3]	410	—	410	3.4
11. Northwood Pulp & Timber[1]	—	370	370	3.0
12. ITT Rayonier[1,5,6]	345	—	345	2.8
13. Federal Paper Board[1,2]	333	—	333	2.7
14. Boise Cascade[1,3,4]	115	215	330[b]	2.7
15. CIP[1,4]	—	290	290	2.4
16. Donohue-St. Felicien[1]	—	283	283	2.3
17. Louisiana-Pacific[1,5,6]	280	—	280	2.3
18. Prince Albert[1]	—	265	265	2.2
19. Cariboo Pulp & Paper[1]	—	250	250	2.0
20. Irving Pulp & Paper[1]	—	240	240	1.9
21. Procter & Gamble (Buckeye)[1,6]*	100	125	225	1.8
22. Western Pulp[1,3,5,6]	—	220	220	1.8
23. Bowater[1,3]	210	—	210	1.7
24. Southwest Forest[1,2,6]	205	—	205	1.6
25. Consolidated Bathurst[1,2,4]**	—	200	200	1.6
26. Crown Forest[1,3]	—	190	190	1.6
27. Domtar[1,2,3,4,5]**	—	175	175	1.4
28. Hammermill[1,2]	160	—	160	1.3
29. Crestbrook[1]	—	150	150	1.2
30. Port St. Joe[1]	145	—	145	1.2
31. Chesapeake[2]	140	—	140	1.1
32. Fraser[5]	—	130	130	1.1
33. Willamette[2]	120	—	120	1.0
34. Maclaren Industries[2]	—	116	116	0.9
35. E.B. Eddy[1,2,4]	—	110	110	0.8
36. Temple-Eastex[1]	100	—	100	0.8

North American capacity (1984): 12.227 million tons
Capacity share of top five companie: 27.6%
Capacity share of top ten companies: 47.9%

Key to grades: 1—bleached softwood kraft; 2—bleached hardwood kraft; 3—semibleached softwood kraft; 4—unbleached softwood kraft; 5—bleached sulfite; 6—fluff pulp.

* Capacity share based on equity ownership (excluding less than 50%-owned affiliates, which in many cases appear as separate listings).

Several companies with major holdings in the market pulp industry are now shown above to avoid double counting of capacity: Noranda, 610,000 tpy (49% of Macmillan Bloedel, 50% of Northwood Pulp, 100% of Maclaren Industries, 63% of Fraser); Canadian Pacific, 600,000 (54% of Great Lakes, 100% of CIP); and Mead, 480,000 tpy (50% of Northwood Pulp, 50% of Brunswick Pulp & Paper and 28% of B.C. Forest Products).

** Exact capacity difficult to estimate because company has some mills which also make dissolving and special alpha pulps or because company is highly integrated.

a. Includes new pulp line at Georgetown, S.C., mill net of production shifted to bleached board at Texarkana, Texas.

b. Includes 190,000-tpy Newcastle, N.B., bleached kraft mill scheduled to be sold to Repap Enterprises Inc. which will use part of mill's output to support a coated groundwood paper expansion.

As a result of these currency trends, the U.S. South has become one of the highest cost market pulp producing regions, while Sweden became one of the lowest cost regions. This is the reverse of the late 1970s when Sweden was at a considerable cost disadvantage due to high wood costs and a strong currency.

The average cost of producing bleached kraft softwood paper-grade market pulp at an existing mill in 1984 (excluding capital and delivery costs) was lowest in western Canada ($277/metric ton), followed by Sweden ($289) and Finland ($319), according to a recent analysis by Fred Robertson, president of Mead Pulp Sales (see table). To the large West European market, lower transportation costs from Scandinavia more than offset Canada's cost advantage, he noted. The U.S. South was one of the highest cost producing areas ($335)—even though southern pine sells at a slight discount to northern softwood.

In hardwood, Brazil was the lowest cost producing region ($157), followed by Portugal ($200) and Sweden ($241), according to the Mead analysis. The South was the highest cost producing area ($324)—and southern hardwood normally sells at a slight discount to Scandinavian birch and eucalyptus. If depreciation and interest were included, however, Brazil would lose some of its advantage due to the high capital costs of its new mills.

Wood costs are the most important factor for the variation in production costs among regions. The cost for softwood in western Canada was estimated at $109/metric ton compared to $120 in the U.S. South and $184 in Sweden. In hardwood, Brazil and Portugal had by far the lowest cost, at $55, while the U.S. South was at $103 and Sweden was at $146, according to Mead.

Another recent analysis made by a private consultant found average southern U.S. manufacturing costs (also excluding capital and delivery charges) slightly lower at $322 for bleached softwood kraft and $273 for bleached hardwood kraft—but still high compared to most other producing regions. Assuming about $60/ton for average capital costs (interest, depreciation and other) and $60 to $80/ton for delivery to Western Europe, the average U.S. producer, at slightly discounted mid-1984 price levels, would appear to be making only around $50 to $60/ton in pretax profit.

Capital costs for building new chemical market pulp

CHEMICAL PAPER-GRADE PULP SHIPMENTS BY NORTH AMERICAN & SCANDINAVIAN PRODUCERS

(000 metric tons)

	1983p	1982	1981	1980	1979	1978	1977
U.S.	4,733	4,172	4,248	4,342	3,781	3,378	3,030
Canada	6,217	5,131	6,024	6,481	6,078	5,953	5,327
Sweden	3,121	2,487	2,816	2,877	3,335	3,714	3,167
Finland	1,744	1,565	1,839	2,057	2,030	1,687	1,304
Norway	202	120	134	75	112	129	172
Total	16,017	13,475	15,061	15,832	15,336	14,861	13,000

p = Preliminary.

Source: North American/Nordic trade associations.

OPERATING RATES FOR NORTH AMERICAN AND SCANDINAVIAN PAPER-GRADE MARKET PULP MILLS

	1983	1982	1981	1980	1979	1978	1977
U.S.	92%	85%	90%	95%	88%	92%	87%
Canada	86	77	89	99	93	83	80
Sweden	87	68	79	90	82	70	62
Finland	82	72	89	95	94	71	58
Norway	90	86	83	84	n.a.	n.a.	n.a.
Total	88	77	87	93	90	80	74

n.a. = Not available.

Source: Norscan trade associations.

mills have gone up dramatically over the past 20 years. The average cost for Leaf River Forest Products's new 1,000-tpd bleached kraft mill at New Augusta, Miss., scheduled to begin running in the fall of 1984, is about $530,000/daily metric ton. This compares to a cost of around $315,000 per ton to build the 1,000-tpd Alabama River Pulp mill at Claiborne, Ala., in 1978 and $110,000 for the original Northwood Pulp & Timber mill in British Columbia completed in 1966.

Cost of building new greenfield mills in tropical countries may run significantly higher. Aracruz, one of the most successful such projects completed in Brazil in the late 1970s, had an original capacity of around 400,000 and cost more than $600 million for an average cost of about $530,000/ton.

FUTURE MARKET OUTLOOK

The continuing rise of the U.S. dollar and the large number of new mills which are starting up make prospects for market pulp in 1985 fairly bleak. The price of NBSK in Europe by February 1985 had already dropped close to the $400/metric ton low reached in the 1982-83 market downturn and was expected to drop further before stabilizing.

Beyond the recent bulge, only limited new market pulp capacity over the next several years has been announced. North American and Scandinavian chemical paper-grade market pulp capacity is expected to rise only from 17.8 million tons in 1983 to 18.6 million tons in 1986, an increase of 780,000 tons or 4%.

NORTH AMERICAN & SCANDINAVIAN CHEMICAL PAPER-GRADE PULP SHIPMENTS BY MAJOR WORLD MARKETS

	1983	1982	1981	1980	1979	1978	1977
U.S.	4,657p	3,811	4,197	4,327	4,493	4,193	3,838
Western Europe[1]	6,137	5,551	6,409	6,536	6,587	6,520	5,653
Japan	1,210	980	947	1,244	1,017	973	689
Nordic countries	n.a.	773	897	991	993	878	733
To other countries	n.a.	2,360	2,611	2,734	2,246	2,297	2,087
Total	16,017	13,475	15,061	15,832	15,336	14,861	13,000

p = Preliminary.
n.a. = Not available.
1. Including U.K.

Source: Norscan trade associations.

NORTH AMERICAN AND SCANDINAVIAN PRODUCER INVENTORIES OF CHEMICAL PAPER-GRADE MARKET PULP

(000 metric tons)

	1984p	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974
January	1,289	1,698	1,579	1,097	745	938	2,119	2,891	2,121	860	628
February	1,059	1,746	1,690	1,194	741	1,006	2,016	2,920	2,260	1,016	628
March	907	1,570	1,767	1,209	747	960	1,857	2,888	2,373	1,326	625
April	997	1,531	1,744	1,193	754	865	1,776	2,760	2,408	1,465	595
May	1,028	1,523	1,840	1,185	801	809	1,612	2,810	2,474	1,754	565
June	1,038	1,435	1,878	1,026	745	737	1,288	2,789	2,588	1,858	532
July	1,038	1,599	1,876	1,116	813	759	1,188	2,822	2,638	1,980	545
August	1,234	1,624	1,923	1,195	916	790	1,193	2,865	2,749	2,101	557
September	1,298	1,475	1,748	1,146	830	734	1,069	2,776	2,720	2,049	538
October	1,494	1,503	1,840	1,373	933	713	1,046	2,656	2,809	2,091	550
November	1,628	1,630	1,809	1,573	1,094	723	1,038	2,577	2,882	2,163	567
December	1,621	1,207	1,603	1,430	949	616	903	2,083	2,824	2,013	611

P = Preliminary.

Source: Norscan trade associations.

Most of the growth will be in the U.S. where capacity is expected to jump 13%, mainly as a result of the two major expansions. Canadian capacity, however, is expected to rise only 2%, while Scandinavia registers a slight decline as Swedish and Finnish mills continue to integrate forward into higher-value-added paper production.

Non-Norscan capacity is expected to rise from about 7.1 million tons in 1983 to 7.6 million tons in 1985 (latest figures for which data are available)—an increase of 510,000 tons or 7%. Western Europe and Asia/Africa will be showing the strongest capacity growth. Only a modest amount of capacity expansion is expected in Brazil over the next couple of years.

The International Statistical Committee of the North American and Nordic Producers Assn. has projected that world demand for chemical paper-grade market pulp will rise 4.0% in 1984 and 0.9% in 1985 to 23.45 million tons (see table). This would result in shipment-to-capacity ratios of 92% in 1984 and 91% in 1985 compared with 90% in 1983 and 77% in 1982. For Norscan producers, the ratios would be 93% in 1984 and 91% in 1985.

TYPICAL DOMESTIC U.S. PRICES FOR BLEACHED KRAFT MARKET PULPS

($/metric ton)

	Northern bl. softwood kraft	Southern bl. softwood kraft	Southern bl. hardwood kraft
1984			
4th quarter	500	470	450
3rd quarter	530*	505*	480*
2nd quarter	540	515	490
1st quarter	470/490	445/465	420/440
1983			
4th quarter	440	415/425	390/400
3rd quarter	437	400	375
2nd quarter	435	400	375
1st quarter	430	364/375	342/353
Year-end			
1982	440	386	353
1981	530/565	496	424
1980	530	507	479
1979	460	441	419
1978	375	353	331
1977	342	287	259
1976	410	353	309
1975	410	353	353
1974	386	386	353
1973	259	246	213
1972	179	179	149
1971	165	160	148
1970	188	179	171

* Significant spot discounting below transaction price levels.

Source: PULP & PAPER PRICEBOOK, 1983.

The longer-run supply/demand outlook for North American market pulp producers is for moderate growth in both demand and supply. One uncertainty on the demand side is how well nonintegrated paper mills in Western Europe and the northeastern U.S. will survive. A number of nonintegrated mills in countries such as Italy and France are continuing to run only because of government assistance. In the U.S., nonintegrated paper capacity has been declining gradually and the trend may accelerate because of the large number of new integrated uncoated free-sheet machines being installed.

The outlook for market pulp export demand from the Far East continues to be encouraging. China, which has limited forest resources, will need larger volumes of long-fiber market pulp for production of printing and packaging grades. Japan's 1.0-million-ton domestic market pulp industry suffers from high production costs due to its heavy reliance on imported woodchips, and future demand growth is likely to be satisfied by market pulp imports.

Demand for fluff pulp in both North America and overseas (see section below) has been growing at more

EXPORT PRICES FOR NORTH AMERICAN BLEACHED SOFTWOOD KRAFT MARKET PULP

($/metric ton, c.i.f. northern Europe)

	Canadian northern bl. softwood kraft	U.S. southern bl. softwood kraft
1984		
4th quarter	490*	460*
3rd quarter	520*	500*
2nd quarter	540	520
1st quarter	(440/490)	(420/470)
1983		
4th quarter	430	400
3rd quarter	425	390/400
2nd quarter	420	390/400
1st quarter	410	370/380
1982	420	390
1981	545	500
1980	545	530
1979	465/475	450
1978	380	360
1977	350	330/340
1976	415*	410*
1975	415	410

* Significant spot discounting below transaction prices.

Source: PULP & PAPER PRICEBOOK, 1983.

than twice the rate of paper-grade pulp consumption.

On the supply side, Scandinavian market pulp capacity will probably continue its gradual decline as Swedish and Finnish mills try to better utilize their limited wood resources by producing higher-value-added paper grades, which on Jan. 1, 1984, gained duty-free entry into the EEC.

Wood resources in both western and eastern Canada are also fairly limited and there is increased interest in forward integration into paper production. Chemithermomechanical pulp, a combination of chemical and mechanical pulping, however, seems to be taking off in both Scandinavia and Canada (see section below). The growth of CTMP (whether for market or internal use) may result in increased competition for chemical market pulp over the next decade.

The U.S. South continues to have available timberland for market pulp expansions due to relatively fast timber growth and strong reforestation programs, although the emphasis is likely to continue to be on

WORLD CHEMICAL PAPER GRADE MARKET PULP CAPACITY

(000 metric tons)

	1981	1982	1983	1984e	1985e	1986e
NORTH AMERICA/SCANDINAVIA						
Canada	6,810	6,810	7,020	7,095	7,075	7,170
U.S.	4,900	4,940	5,085	5,130	5,605	5,755
Sweden	3,830	3,595	3,455	3,455	3,510	3,550
Finland	2,160	2,150	1,990	1,825	1,755	1,765
Norway	140	220	220	310	310	310
Total Norscan	**17,840**	**17,715**	**17,770**	**17,815**	**18,225**	**18,550**
OTHER WORLD REGIONS						
Austria	290	290	315	315	315	
Benelux	205	240	240	240	240	
France	595	680	750	770	780	
Germany	140	105	105	105	105	
Portugal	705	735	770	950	1,005	
Spain	520	520	570	570	570	
Switzerland	110	110	115	115	120	
Total western Europe	**2,565**	**2,715**	**2,865**	**3,065**	**3,135**	
Argentina	10	10	140	155	190	
Brazil	1,470	1,460	1,530	1,590	1,610	
Chile	450	465	490	465	465	
Total Latin America	**1,930**	**1,935**	**2,160**	**2,210**	**2,265**	
Japan	**1,070**	**1,070**	**1,035**	**1,035**	**1,035**	
Australia	5	5	5	15	25	
New Zealand	335	335	320	320	320	
Total Oceania	**360**	**360**	**325**	**335**	**345**	
Cameroon	60	70	—	—	—	
Indonesia	—	—	—	25	45	
Morocco	95	95	95	95	95	
Philippines	45	55	10	15	15	
South Africa	55	55	40	100	100	
Swaziland	175	175	170	170	170	
South Korea	90	105	105	105	105	
Taiwan	260	330	305	310	310	
Total Asia/Africa	**780**	**885**	**725**	**820**	**840**	
TOTAL WORLD	**24,545**	**24,680**	**24,880**	**25,280**	**25,875**	

e = Estimate

Source: American Paper Institute.

integrated paper expansion. Georgia-Pacific Corp. and Hammermill Paper Co., for example, have announced uncoated free-sheet machines at existing market pulp mills which will take more than 330,000 tons of available pulp off the market by 1988.

Nontraditional suppliers in subtropical and tropical regions will continue to grow in importance. The time required for a eucalyptus plantation to reach maturity in Brazil is about 7 years compared with roughly 20 years for southern U.S. loblolly pine and perhaps 80 years or more for Canadian spruce and fir. Eucalytpus market pulp production from countries such as Brazil, Portugal, Spain, and Morocco has grown from 434,000 metric tons in 1976 to around 2.2 million tons in 1983—or from 13.3% to 33.6% of total world hardwood production.

U.S. southern hardwood market pulp producers will probably face increasing competition in export markets from Brazil and other eucalyptus producers. Another major round of expansion at existing and new sites may take place in Brazil in the late 1980s or early 1990s. Major softwood plantations are also under development in a number of countries, including Brazil, Chile, and New Zealand.

The Soviet Union has been making some progress in developing its enormous softwood timber resources, but capital constraints and a large domestic market will probably limit market pulp exports. Latest available statistics show that Russia had total chemical paper pulp exports of 888,000 and imports of 222,000 tons in 1982. Most of these exports go to other East Bloc countries or Western Europe.

Thus, the supply of northern bleached softwood kraft pulp should show only modest growth. But demand will probably also grow slowly because of competition from lower-cost southern pine and hardwood pulps which papermakers are becoming more adept at using in their fiber furnishes.

WORLD CHEMICAL PAPER-GRADE MARKET PULP CAPACITY, POTENTIAL PRODUCTION AND DEMAND FORECAST

(000 metric tons)

	1982		1983		1984	1985
CAPACITY	**Capacity**	**Actual Production**	**Capacity**	**Actual Production**	**Capacity**	**Capacity**
Total world[1]	24,510	19,195	24,880	21,995	25,280	25,875
Potential production[2]	22,790		23,230		23,000[3]	25,875
DEMAND (shipments)	**Actual**		**Prelimary**		**Estimated**	**Estimated**
Canada	610		735		790	800
U.S.	3,940		4,725		4,950	4,900
Nordic countries	820		980		990	945
Western Europe	8,120		9,145		9,500	9,450
Eastern Europe	260		255		240	240
Latin America	935		1,015		1,050	1,100
Japan	1,950		2,265		2,550	2,700
Oceania	275		255		240	240
Asia Africa, inc. China	2,075		2,960		2,925	3,075
Total	**18,985**		**22,335**		**23,235**	**23,450**
RATIO						
Demand/potential production	**83%**		**96%**		**101%**	**97%**
Demand/capacity	**77%**		**90%**		**92%**	**91%**

1. Excluding eastern Europe and China.
2. Potential production: 95% of capacity for North America and Nordic countries.
   90% of capacity for western Europe, Japan (and Latin America 1983-85).
   85% of capacity for others (and Latin America 1982).
3 Excludes 585,000 tons lost in British Columbia labor dispute from Feb. 2, 1984 to March 29, 1984 (when this report was prepared).

Source: American Paper Institute.

MECHANICAL PULPS

Mechanical pulps are produced from either the groundwood, refiner mechanical, or thermomechanical pulping processes. A newer process is chemi-thermomechanical pulping, which combines both chemical and mechanical pulping. Mechanical market pulp capacity at five mills in Canada and one in the U.S. was only about 540,000 tpy in 1984, but future growth is expected because of low capital costs and high yields compared to the kraft process. Almost all of this growth will be in the newer TMP and CTMP processes.

There are a number of different grades of mechanical pulp on the market at different brightness and freeness levels. With the development of peroxide bleaching in the 1970s, brightness levels up to 75 to 80 Elrepho have become standard. Mechanical pulps offer opacity in newsprint and printing/writing papers and bulk and absorbency in sanitary tissue and disposable diapers. Some mechanical pulp has also been used in boxboard.

Most of the older mechanical market pulp mills use the stone groundwood process, but Finlay Forest Industries Ltd. operates a recently expanded 140,000-tpy refiner mechanical pulp mill at Mackenzie, B.C., and Quesnel River Pulp Co. in 1981 began operation of a 160,000-tpy market TMP mill at Quesnel, B.C. Quesnel River, a joint venture between West Fraser Timber Co. Ltd. and Daishowa Paper Manufacturing Co. of Japan, installed capability to make CTMP in 1983. CTMP offers higher brightness and freeness than TMP, which will also continue to be made and exported to Japan for use in newsprint.

Tembec Inc. has announced plans to build a 90,000-tpy bleached market CTMP mill adjacent to its Temiscaming, Que., sulfite pulp mill. The C$75-million project would be completed in mid-1986. The company has also signed an agreement with Svenska Cellulosa AB (SCA) of Sweden to cooperate in marketing Scandinavian CTMP pulp in North America. At least four other CTMP projects are known to be under study in Canada, either conversions of existing mills or completely new mills, as well as one project in the U.S. Northwest.

MAJOR CHEMICAL PAPER-GRADE MARKET PULP PRODUCERS OUTSIDE NORTH AMERICA

Company	Country (mills)	Estimated capacity (000 metric tpy)
Södra Skogsägarna[1,2,3]	Sweden (Mönsterås, Mörrum, Väro)	820
Mo och Domsjö	Sweden (Husum, Örnsköldsvik)	605
Stora Kopparberg[1,2,4,6]	Sweden (Skutskär, Sandarne)	540
Portucel[1,2]	Portugal (Aveiro, Setubal, Vila Velha de Rodaõ)	465
Aracruz Celulose[2]	Brazil (Aracruz)	420
Empresa Nacional de Celulosas (ENCE)[1,2,4]	Spain (Huelva, Burgos, Pontevedra)	410
Celulosa Arauco & Constitución[1,4]	Chile (Arauco, Constitución)	330
Taio Paper[1,2]	Japan (Mishima)	325
Soporcel[2]	Portugal (Leirosa)	300
Oulu[1,2,3]	Finland (Oulu)	280
Svenska Cellulosa[1,2,6]	Sweden (Östrand)	270
Jari Florestal[2]	Brazil (Monte Dourado)	260
Celulose Nipo Brazileira (Cenibra)[2]	Brazil (Belo Oriente)	260
Rio Grande Cia de Celulose du Sul (Riocell)	Brazil (Guaiba)	250
Cellulose du Rhône[1]	France (Tarascon)	240
Kaukas[1,2,4]	Finland (Lappeenranta)	235
Norrlands Skogsägares[1,5,6]	Sweden (Vallvik)	180
Usutu Pulp[4]	Swaziland (Bhunya)	175
Tasman Pulp & Paper[1,4]	New Zealand (Kawerau)	175

Key to grades: 1—bleached softwood kraft; 2—bleached hardwood kraft; 3—semibleached softwood kraft; 4—unbleached softwood kraft; 5—bleached sulfite; 6—fluff pulp

PULP EXPORTS FROM MAJOR PRODUCING COUNTRIES IN 1983

(000 metric tons)

Importer	**Exporter**					
EUROPE	**USA**	**Canada**	**Sweden**	**Finland**	**Norway**	**Brazil**
Austria	36	18	33	7	8	18
Belgium	87	142	59	34	20	61*
Czechoslovakia	-	-	16	35	3	-
Denmark	-	4	57	27	15	11
Finland	-	14	8	-	-	-
France	206	264	324	137	43	67
German Dem. Rep.	-	-	1	28	1	4
Germany, Fed. Rep.	503	547	593	354	83	121
Greece	11	30	40	23	2	-
Hungary	-	4	11	9	1	-
Italy	225	284	305	144	41	29
Netherlands	130	166	235	68	50	25
Norway	-	-	90	15	-	-
Poland	-	3	10	7	14	-
Romania	1	-	3	-	1	-
Spain	33	40	55	21	14	-
Sweden	2	17	-	9	16	21
Switzerland	32	26	74	41	5	4
United Kingdom	255	255	291	203	79	76
USSR	6	-	46	133	61	-
Yugoslavia	13	11	12	1	-	-
Other	5	9	18	16	1	-
Total Europe	**1,559**	**1,834**	**2,281**	**1,312**	**458**	**437**
NORTH AMERICA						
Canada	57	-	3	-	-	-
United States	-	4,368	70	18	4	157
Total North America	**57**	**4,368**	**73**	**18**	**4**	**157**
ASIA/AUSTRALASIA						
Australia	12	62	7	16	1	-
China	63	298	163	50	9	18
Hong Kong	7	27	-	0	-	-
India	25	45	24	7	5	-
Indonesia	92	53	61	26	-	19
Iran	-	-	62	2	5	-
Iraq	-	-	7	0	-	-
Israel	11	7	15	16	1	-
Japan	641	1,181	115	49	1	176
Korea, Rep. of	182	95	47	2	5	13
Taiwan	67	52	27	9	-	-
Thailand	17	10	49	2	-	-
Turkey	6	-	23	10	1	-
Other	20	33	38	10	2	10
Total Asia/Australasia	**1,139**	**1,845**	**638**	**199**	**30**	**226**
LATIN AMERICA						
Argentina	5	10	1	0	-	23
Mexico	135	23	-	0	-	4
Venezuela	92	31	-	0	-	11
Other	48	11	6	7	1	14
Total Latin America	**280**	**75**	**7**	**7**	**1**	**52**
AFRICA						
Algeria	-	8	31	7	-	-
Egypt	10	9	6	5	-	-
Morocco	-	-	23	2	2	-
South Africa	65	71	1	11	-	36
Other	6	1	27	11	2	7
Total Africa	**81**	**89**	**88**	**35**	**4**	**43**
WORLD TOTAL	**3,104**	**8,211**	**3,087**	**1,572**	**497**	**927**

**Total which entered through Belgian ports, not necessarily for Belgian mills.*

Source: PULP & PAPER INTERNATIONAL, Annual Review, August 1984

Stephen G. Williams of Nystrom, Lee, Kobayashi & Associates, a Montreal engineering firm, recently compared the economics of building a bleached CTMP mill vs a kraft mill in eastern Canada. The CTMP mill would have a capacity of 600 tpd and cost C$140 million compared with $470 million for an 800-tpd kraft mill. This would result in an average capital cost of $230,000/daily ton for the CTMP mill vs $580,000 for the kraft mill. Manufacturing cost would be $290/metric ton for the CTMP installation vs $400/ton for the kraft mill because of lower wood and labor costs. Wood yield for the CTMP line would be 90% vs 45% for the kraft operation.

He estimated the potential for bleached CTMP usage for a number of grade segments: towelling (20% to 100%), tissue (40% to 50%), bleached board (10% to 50%), printing/writing grades (10% to 30%), fluff (50% to 85%). The CTMP would be mainly replacing hardwood and softwood kraft in these grades plus some groundwood pulp. Canada is best suited for CTMP pulp production because of optimum wood species and availability of low cost hydro power.

Bleached CTMP market pulp is already off to a strong start in Scandinavia. New market bleached CTMP mills ranging in size from 55,000 to 95,000 tpy have been installed since 1979 by Rockhammars Bruks AB, Billeruds Bruk, and Svenska Cellulosa AB (SCA)—all of Sweden—and Folla Fabrikker of Norway. In some cases, such as Billerud's CTMP line at Skoghall, production is partially integrated. G.A. Serlachius Oy has announced a new 70,000-tpy CTMP mill for startup in Tampere, Finland, in early 1986 and MoDo (Mo och Domsjö AB) and Iggesunds Bruk AB plan to build a 65,000-tpy CTMP mill for completion in 1985. In New Zealand, Winstone Samsung Industries Ltd. converted its TMP mill to CTMP in 1982 and more recently expanded production to 120,000 tpy.

The rosy forecasts for CTMP market pulp, however, may result in serious over-expansion unless considerable "missionary work" is done to persuade papermakers to use the new pulp.

NONPAPER PULPS

Dissolving pulps, also referred to as chemical cellulose, are highly purified grades of market pulp, composed of 95% to 99% cellulose. These pulps are used to produce manmade fibers (rayon and acetate), films (cellophane), plastics (cellulose acetates) and chemicals (methyl cellulose and carboxymethyl cellulose). Two processes are used for producing dissolving pulps, mainly from softwood although some hardwood is used: (1) the prehydrolyzed sulfate process, and (2) the modified acid sulfite process. By these processes, a number of grades of varying quality can be made, each suitable for different end-uses.

MAJOR CHEMICAL PAPER-GRADE MARKET PULP EXPANSIONS ANNOUNCED WORLDWIDE

North America	**Location**	**Capacity/grade**	**Completion**
Leaf River Forest Products	New Augusta, Miss.	335 BSK, BHK	Fall 1984
International Paper	Georgetown, S.C.	320 BKS¹ (partly fluff)	Fall 1984
Champion Intl.	Quinnesec, Mich.	235 BHK	Early 1986
Western Pulp	Squamish, B.C.	65 BSK	1987
Scandinavia/Western Europe			
Metsä-Botnia	Äänekoski, Finland	110 BSK, BHK²	Summer 1985
Soporcel	Leirosa, Portugal	300 BHK	Summer 1984
Pölser Zell. & Papierfabrik	Pöls, Austria	200 BSI	Late 1984
Eastern Europe			
Severomoravské Cel. a Pap.	Paskov, Czechoslovakia	200 BSI³	Summer 1984
Latin America			
Celgusa	El Progreso, Guatemala	100 BSK	Mid 1980s
Aracruz	Aracruz, Brazil	60 BHK	1984
Africa			
Mondi Paper	Richards Bay, South Africa	200 BSK, BHK	Late 1[illegible]
Sappi	Ngodwana, South Africa	250 BSK, BHK	Late 1984

Key: BSK—bleached softwood kraft; BHK—bleached hardwood kraft; BSI—bleached sulfite.

Net increases for three projects footnoted below will be smaller:

1. International Paper may shift up to 100,000 tpy of market pulp production to bleached board at its Texarkana, Texas, mill.
2. Three affiliated companies will shut down some sulfite capacity.
3. Replaces 40,000 tpy sulfite mill.

The quality of a dissolving pulp grade for a particular process depends on its purity and reactivity for a given process. For example, sulfite dissolving pulps are generally considered to be the most reactive pulps and are suitable for producing rayon and cellophane made under lenient rayon (viscose) processing conditions. Prehydrolyzed sulfate pulps generally produce a stronger rayon fiber for such uses as high wet-modulus textile rayon and for high-tenacity rayon tire cords. Cotton linter is also used to produce cellulose acetates and cellulose plastics, but is rarely used for producing rayon fibers.

Chemical cellulose products can be divided into four groups based on the processes—viscose, acetate, ethers, and nitration—used to convert them. (1) Viscose products are the largest group and consume about 60% of dissolving pulp shipped. About 75% of viscose production consists of rayon for textiles and tire cord, with the remainder going into cellophane and such products as sausage casings and sponges. (2) Acetate products are the second largest group and include textiles, cigarette filters, rigid packaging, photographic film, and high-quality plastics. (3) Cellulose ethers are finding increased use in pharmaceuticals, cosmetics, detergents, food products, agricultural chemicals and additives for oil well-drilling muds. (4) Cellulose nitrates are used in explosives, lacquers, printing inks and rocket fuels.

Dissolving pulp producers in recent years have been hurt by sharp cost escalations for wood and energy, plus the growing acceptance of lower-cost synthetic fibers and films. Rayon staple, for example, has been under heavy competitive pressure from polyester, while plastic films such as oriented polypropylene have been displacing cellophane.

This development has been reflected in U.S. dissolving pulp production, which declined from a peak of around 1.6 million metric tons in the mid-1970s to a low of 987,000 tons in the 1982 recession, before recovering to 1.1 million metric tons in 1983. Canadian dissolving pulp production has followed a similar trend, declining from a peak of 450,000 tons (st) in 1969 to 217,000 tons last year. ITT Rayonier Inc. shut down a troubled 300,000-tpy sulfite dissolving and paper grade pulp mill at Port Cartier, Que., in 1979 and [illegible] closed its older 70,000-tpy [illegible] sulfite dissolving pulp mill at the end of 1982.

Even with these closures, considerable overcapacity remains. Demand for U.S. dissolving pulp has not shown much further improvement and operating rates through the first half of 1984 were just 80%—about the same level as in 1983. Dissolving pulp prices did not decline as sharply as paper grade pulp prices in the

ESTIMATED 1984 AVERAGE COSTS OF PRODUCING BLEACHED KRAFT PAPER GRADE MARKET PULP AT EXISTING MILLS[1]

(U.S.$/A.D. metric ton)

SOFTWOOD

	Western Canada	Sweden	Finland	U.S. South
Fiber	108	166	227	104
Chemicals	41	31	48	35
Energy	38	14	9	30
Wages/salaries	48	55	51	29
Other	42	27	27	36
Total (excl. interest & depr.)	277	288	316	233

HARDWOOD

	Brazil	Portugal	Sweden	Finland	U.S. South
Fiber	55	93	148	152	101
Chemicals	40	31	40	47	31
Energy	15	28	10	16	33
Wages/salaries	27	33	34	31	28
Other	46	59	28	27	27
Total (excl. interest & depr.)	183	206	261	268	223

[1] Excluding capital and transportation costs.

Source: Fred Robertson, Wood Pulp Sales Inc.

increases, but so far have firmed only modestly. Industry observers said that first-half U.S. domestic market prices for viscose cellophane pulp were in the low $700/metric-ton range, while viscose rayon staple grades were near the mid-$700 range and acetate grades were in the $800 range.

Dissolving pulp export prices were reported to be somewhat weaker in Europe and Asia due to the strength of the dollar. Producers have been trying to firm up prices in Asia where viscose rayon grade pulp

NORTH AMERICAN DISSOLVING PULP PRODUCERS ESTIMATED MILL CAPACITIES[1]

(000 metric tons)

Company	Prehydrolyzed sulfate pulp	Sulfite pulps	Cotton linters[3]	Total
1. ITT Rayonier total	180 (410)	225 (340)	—	405 (750)
Fernandina Beach, Fla.	—	110 (140)	—	—
Jesup, Ga.	180 (410)	—	—	—
Hoquiam, Wash.	—	(45)[2]	—	—
Port Angeles, Wash.	—	115 (155)	—	—
2. Buckeye Cellulose total	190 (425)	—	50 (85)	240 (510)
Foley, Fla.	190 (425)	—	—	—
Memphis, Tenn. (CL)[3]	—	—	50 (85)	—
3. Alaska Lumber & Pulp Sitka, Alaska	—	200 (200)	—	200 (200)
4. International Paper Co. Natchez, Miss.	190 (280)	—	—	190 (280)
5. Louisiana-Pacific Corp. Ketchikan, Alaska	—	75 (150)	—	75 (150)
6. Tembec Forest Products Temiscaming, Que.	—	110 (140)	—	110 (140)
7. Western Pulp Inc. Port Alice, B.C.	—	105 (140)	—	105 (140)
8. Weyerhaeuser Co. Cosmopolis, Wash.	—	60 (150)	—	60 (150)
9. Hercules Inc. Hopewell, Va.	80	—	80	80
10. Alpha Cellulose Corp. Lumberton, N.C.	40	—	40	40
11. Southern Cellulose Chattanooga, Tenn.	30	—	30	30

[1] Capacity for dissolving and special alpha pulp is difficult to estimate since most mills also produce some paper-grade and fluff pulps. Figure in parentheses represents total mill capacity including all grades. Total dissolving and special alpha pulp capacity of U.S. mills listed in this table is 1.32 million metric tons, while estimated U.S. capacity in 1984 was rated at 1.40 million metric tons and production was running at a level of 1.16 million tons. The two Canadian mills shown in this table have a combined capacity of 215,000 tons, which is about the same as total capacity reported by the Canadian Pulp and Paper Assn.

[2] Hoquiam mill has been supplying kraft pulp to adjacent Grays Harbor Paper Co. mill during the last couple of years only.

[3] Purified cotton linters (CL) are produced for both paper and chemical cellulose users.

Source: PULP & PAPER

prices dropped as low as $320 to $350/metric ton in 1983 due to fierce competition among producers—particularly from Saiccor, a highly efficient South African mill owned by Courtaulds Ltd. Alaska Pulp Co., which operates a sulfite dissolving pulp mill at Sitka, Alaska, that supplies Japan and other Far East markets, reported a $57 million loss for its fiscal year ended in March 1974, bringing its cumulative deficit to $120 million over the last several years.

While not suffering losses on this scale, other Pacific Northwest sulfite dissolving pulp mills owned by Louisiana-Pacific Corp., ITT Rayonier, Western Pulp Ltd. Partnership and Weyerhaeuser Co. have also been struggling for survival. There was speculation that ITT might again try to sell all or part of its Rayonier unit and L-P recently tried unsuccessfully to sell a half interest in its Ketchikan, Alaska, mill to an employee trust.

ITT Rayonier, the largest North American dissolving pulp producer, has predicted that chemical cellulose products will grow at about a 1%/year rate during the 1980s. On a tonnage basis, most of this growth is expected to be in regular rayon staple, principally in demand from Asia. The fastest percentage growth is expected to be in high-performance rayons (such as Rayonier's improved high-wet-modulus Prima staple fiber, said to offer cotton-like quality and high durability) and in cellulose ethers and nontextile acetate uses such as cigaret filters. Other cellulose acetate markets are seen as fairly stable, with the exception of cellophane, which is expected to continue to decline.

Some efforts are also being made to improve the viscose process, which is highly capital- and energy-intensive and involves the use of toxic and flammable chemicals. In the process, cellulose is treated with caustic soda and carbon disulfide to form cellulose xanthate, which is then dissolved in a weak caustic solution to form the viscose used to spin rayon staple. Major U.S. rayon producers include American Enka Co., Avtex Fibers, Courtaulds North America Co., and North American Rayon Co.

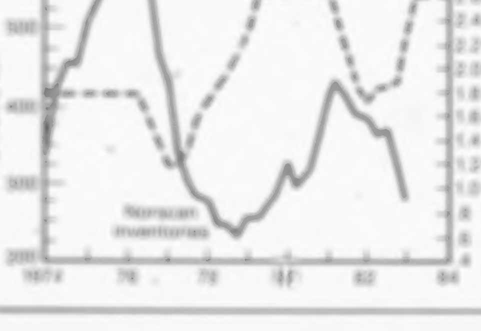
About 24% of world dissolving pulp capacity of 6.1 million metric tons in 1983 was in the U.S. and another 3.3% in Canada, according to the Food & Agricultural Organization of the United Nations. The Scandinavian countries account for 9.5% of total capacity, the rest of western Europe for 10.3%, Japan for 7.3%, eastern Europe for 8.8% and the Soviet Union for 26.6%. The most important markets are in western Europe, which account for about half of total consumption, followed by North America and Japan.

Fluff pulp is produced in either roll or bale form and shipped to sanitary disposable products manufacturers, who then disintegrate the thick pulp sheets into individual fibers to provide their products with bulk, softness and high absorbency. The main use has been in baby diapers, which account for something like 80% of the fluff pulp market, but incontinent adult diapers, feminine sanitary products, underpads and absorbent bandages are other expanding uses.

The fluff pulp market has been growing at about an 8%/year rate over the past several years, although growth over the past decade has been something like 20%/year. Estimates of market size are difficult to obtain since no trade association data are published on fluff pulp production and some producers closely guard their capacity estimates. Data Resources Inc. estimates 1983 U.S. fluff pulp consumption at around 820,000 tons and total world consumption at 1.8 million tons.

Another consultant has estimated North American consumption at 890,000 tons, western European at 690,000 tons, Latin American at 85,000 tons, Asian at 73,000 tons and eastern European at 54,000 tons.

RELATIONSHIP OF NORSCAN PRODUCER PULP INVENTORIES AND THE PRICE OF NORTHERN BLEACHED SOFTWOOD KRAFT DELIVERED IN NORTHERN EUROPE



SHIPMENTS AND OPERATING RATES FOR NORSCAN DISSOLVING PULP MILLS

(000 metric tons; percent)

	1983p	1982	1981	1980	1979	1978
U.S.	1,129	996	1,217	1,354	1,375	1,297
	79%	71%	86%	96%	97%	86%
Canada	210	226	270	310	371	334
	n.a.	73%	91%	92%	93%	79%
Nordic	398	348	432	427	527	513
	n.a.	68%	68%	75%	78%	72%
Total	1,737	1,570	1,919	2,091	2,273	2,153
	n.a.	70%	82%	90%	91%	83%

p = Preliminary
n.a. = Not available

Source: American Paper Institute

Major North American manufacturers and their estimated production capacities include Procter & Gamble Co. (about 400,000 tpy), Weyerhaeuser (370,000), International Paper (250,000), ITT Rayonier (200,000) and Kimberly-Clark Corp. (165,000). Weyerhaeuser is believed to be the largest open market seller of fluff, while P&G and K-C mainly produce it for internal use. Other smaller producers include Southwest Forest Industries Inc., Tembec Inc., Western Pulp, Brunswick Pulp & Paper Co., and Georgia-Pacific.

Fluff pulp is made mainly from bleached softwood kraft (southern pine or Douglas fir) and is fairly similar to paper-grade pulp; it is somewhat more expensive due to special sheet properties and packaging. Because of the overhang in dissolving pulp capacity, a number of sulfite dissolving pulp mills have been trying to produce fluff pulp grades. They face an uphill battle, however, since softwood kraft is preferred for most (but not all) applications because of its superior absorptive capacity. Some mechanical pulp, mainly TMP or CTMP, is also being used in Europe. Tembec has announced plans to produce some fluff at the new CTMP mill planned for its Temiscaming, Que., complex.

Fluff pulp normally sells at a slight premium to comparable paper-grade pulps and has been less subject to discounting. The price of untreated bleached softwood kraft in rolls rose to $555/metric ton in the U.S. in the second quarter of 1984, while the price to northern Europe increased to $585. U.S. exports of fluff pulp now probably amount to 300,000 tons or more annually, with western Europe and Japan the largest markets. Major competitors in Europe include such Scandinavian mills as Stora Kopparberg Bergslags AG, Korsnäs-Marma AB and Norrlands Skogsägares Cellulosa AB (NCB).

Procter & Gamble is the largest U.S. consumer of fluff pulp, with about 54% of the U.S. baby diaper market in 1983, down from a commanding 75% share for its Pampers and Luvs brands in the mid-1970s, according to estimates in *Advertising Age*. Most of this loss was to Kimberly-Clark's Huggies brand, which has grown from a 14% share in 1982 to 24% in 1983. Private label producers, the largest of which is probably Weyerhaeuser, accounted for 22% of the baby diaper market in 1983.

Adult diapers, which are now beginning to go into mass marketing in the U.S., represent a major new growth area for fluff pulp. Medical surveys have placed the number of people in the U.S. who suffer from some degree of incontinence at 8 to 10 million.

The two major adult diaper entries in the U.S. market are Attends produced by P&G and Depend introduced by K-C. Made with 100% fluff pulp, Attends is a larger and bulkier version of the company's baby diaper aimed mainly at the institutional care market. Depend is made with a patented superabsorbent material, Coform, which consists of a blend of polypropylene and cellulose fibers, and is less bulky. The potential size of the market for fluff pulp will depend partly on how much superabsorbent is used in the new adult diapers.

Another developing market for fluff pulp is in air-laid or dry-formed manufactured products such as Fort Howard Paper Co.'s industrial wipe and James River Corp.'s reusable kitchen towel and medical wipes.

PLANNED DISSOLVING PULP TOTAL CAPACITY

(000 metric tons)

	1983	%	1988	%	% change
U.S.	1,455	23.9	1,455	23.1	0
Canada	201	3.3	232	3.7	15.4
Japan	449	7.4	449	7.1	0
Finland	345	5.7	285	4.5	−17.4
Norway	160	2.6	170	2.7	6.3
Sweden	75	1.2	75	1.2	0
South Africa	440	7.2	500	7.9	13.6
U.S.S.R.	1,625	26.6	1,700	26.9	4.6
Asia[1]	225	3.7	300	4.8	33.3
Western Europe[2]	538	8.8	547	8.7	1.7
Eastern Europe[3]	532	8.8	519	8.2	−2.4
Latin America	5.7	0.9	77	1.2	35.1
Total	6,102	100.0	6,309	100.0	3.4

1. Excludes Japan.
2. Excludes Nordic Countries.
3. Excludes U.S.S.R.

Source: 1984 Food & Agriculture Organization capacity survey

PULPING PROCESSES

Before paper can be made, papermakers must be furnished with a supply of fibers capable of producing a paper or board grade with desired strength properties and good runability on paper machines. The primary sources of fiber for papermaking are: (1) pulpwood, (2) wastepaper, (3) nonwood fibers, and (4) inorganic fibers. In the U.S. about 1% of the fiber supplied for paper and board making is from nonwood and inorganic fiber sources such as asbestos or bagasse. About 76% of the fiber supply is derived from pulpwood and 23% from wastepaper.

Pulping is the chemical or mechanical process of freeing fibers from wood. The goal of pulping is to disintegrate or separate wood fiber into its individual fibers without reducing fiber lengths or damaging strength properties. Pulping is accomplished in two

U.S. WOODPULP PRODUCTION

(000 short tons)

	Total all grades	Special alpha/ dissolv.	Bl. sulfite	Unbl. sulfite	Bl. & semibl. sulfate & soda* Softwood	Bl. & semibl. sulfate & soda* Hardwood	Unbl. sulfate	Semi-chemical	Ground-wood & thermo-mechanical
1983p	47,659	1,144	1,186	281	10,377	8,769	17,812	3,494	4,597
1982	44,755	991	1,127	313	10,189	7,702	16,484	3,356	4,594
1981	47,212	1,227	1,273	362	10,552	7,656	17,757	3,560	4,826
1980	46,027	1,369	1,324	349	9,867	7,369	17,773	3,652	4,324
1979	44,781	1,360	1,250	358	9,359	7,024	17,762	3,681	3,985
1978	43,032	1,277	1,286	298	9,022	6,494	17,247	3,657	3,750
1977	42,319	1,329	1,499	353	9,016	5,909	16,697	3,516	3,999
1976	41,187	1,348	1,587	380	8,476	5,833	16,171	3,478	3,911
1975	36,838	1,241	1,505	332	6,457	5,114	13,814	3,102	4,003
1974	40,676	1,607	1,736	354	6,960	5,812	15,407	3,437	4,074
1973	41,084	1,517	1,742	338	6,646	5,479	15,955	3,531	4,393
1972	39,544	1,521	1,629	302	6,247	5,103	15,668	3,443	4,180
1971	37,211	1,528	1,503	334	5,915	4,616	14,373	3,256	4,279
1970	37,050	1,557	1,733	361	5,683	4,803	14,206	3,091	4,066
1965	28,855	1,348	2,077	454	3,961	2,822	10,695	2,606	3,540
1960	21,755	1,032	1,855	483	3,754	1,191	7,878	1,807	2,959
1955	17,570	892	1,732	586	2,659	646	6,962	1,264	2,450
1950	12,447	434	1,478	672	2,100		5,179	611	1,973

p = Preliminary.

* Bureau of the Census data show that semibleached sulfate production declined from 1.729 million metric tons in 1970 to 1.078 million tons in 1980—the last year production was broken out; soda pulp production was last shown by Census at 181,000 tons in 1974.

Source: American Paper Institute.

ways: either by mechanical or chemical forces, or by a combination of the two. There are many different mechanical and chemical processes for pulping (or cooking) pulpwood. The pulping process chosen depends on one primary requirement: the grade of pulp required to make the strength requirements of a specific paper or board grade.

In mechanical pulping, mechanical energy through grinding or attrition is used to separate the fibers from one another. In chemical processes, strong chemicals and high temperatures are used to dissolve the binding material between the fibers, and once these binding materials (lignins) are partially removed or dissolved, the fibers will separate with a minimum of mechanical action, referred to as refining.

PULPWOOD SUPPLY

The pulpwood species used depends on the mill's location and the paper or board grades produced. In the U.S. South, principal species used are southern pine, mixed hardwood and oak. In the Pacific Northwest, the major species used are Douglas fir, hemlock, western pines and small amounts of western cedar, redwood and spruce. In the U.S. Midwest, the principal species are mixed hardwoods, oak and spruce. In the U.S. and Canadian Northeast, the major species used are eastern spruces, pines, balsam fir and mixed hardwood (poplar, white birch).

Because of increasing pressure on available softwood timber supplies, the percentage of hardwood used for producing pulp is expected to rise gradually. Hardwoods comprise about 36% of the commercial timber supply in the U.S. and about 20% of total timber volume in Canada. In the U.S., hardwoods have grown from only 10% of total pulp production in the mid-1940s to around 25% currently. However, in Canada hardwoods have accounted for only 5% to 10% of pulp produced in recent years—a situation that partly reflects the Canadian industry's concentration on bleached softwood kraft pulp and newsprint.

Pulpwood is delivered to the pulp mill in either chip or log form. In the U.S. Pacific Northwest, about 70% of the pulpwood used is sawmill residues. The concept of using a tree for its greatest value—first using logs for lumber or plywood value and then using the residuals from the sawmills for either energy or pulpwood—has been practiced in the Northwest since the 1920s. Now this approach is increasingly being used in the U.S. South, where rotation cycles are being extended to yield more timber which can be processed into higher value lumber and plywood. It is expected that within the next decade as much as 50% of the pulpwood delivered to southern mills will be in the form of byproduct woodchips. In the Northeast, both in Canada and U.S., most of the pulpwood delivered to mills is in roundwood form; however, even in this area there is a trend to using more sawmill chips.

A major drawback to heavy use of residuals is that the availability and cost of chips becomes tied to the

U.S. PULPWOOD CONSUMPTION BY PULPING PROCESS

(000 cords of 128 ft^3)

	1982	1981	1980	1978	1976	1974	1972	1970
All processes, total	73,642	79,350	79,703	74,170	72,011	74,327	71,538	67,562
Dissolving and special alpha	2,407	2,956	3,378	3,056	2,777	3,953	3,425	3,673
Sulfite, total	n.a.	n.a.	3,494	3,125	4,426	4,722	4,697	5,016
Bleached	2,316	2,556	2,618	2,381	3,444	3,565	3,674	3,849
Unbleached and soda	n.a.	n.a.	876	744	982	1,157	1,023	1,167
Sulfate, total	59,112	62,684	62,408	57,944	54,581	55,301	53,085	49,366
Bleached and semibleached	29,155	29,814	30,110	26,803	24,697	25,603	23,303	22,327
Unbleached	29,957	32,870	32,299	31,141	29,884	29,698	29,782	27,039
Groundwood[1]	4,387	4,547	4,483	4,098	4,226	4,413	4,411	4,234
Semichemical	3,403	3,929	3,853	3,491	3,609	3,775	3,738	3,456
Defibrated or exploded	n.a.	n.a.	2,087	2,456	2,352	2,162	2,182	1,818

n.a. = Not available.

1. Includes chemigroundwood.

Source: Bureau of the Census.

PULPING PROCESSES USED AT NORTH AMERICAN PULP & PAPER MILLS

(Number of mills by state or province)

	Paper & Board Mills*	Pulp Mills	Types of Pulp Installations						
			Sulfite (includes bleached & unbleached)	**Kraft** (includes bleached & unbleached kraft, soda, fluff)	**Semi-chemical**	**Groundwood** (includes mechanical)	**Refiner-mechanical†**	**Other** (includes bagasse, cotton, flax, hemp, jute, rag, synthetic pulp)	**Deinked pulp**
UNITED STATES									
Alabama	16	15		16	2	3	4		
Alaska	—	2	1						
Arizona	2	2		2		1			2
Arkansas	12	8	1	8			1		
California	34	10		6	1		2		3
Colorado	2	—							
Connecticut	12	1						1	
Delaware	5	—							
Florida	12	10	1	12			1		
Georgia	23	18		15	1	1	6		2
Idaho	2	1		1					
Illinois	19	5					5		1
Indiana	12	1			1				
Iowa	3	2			2		1		
Kansas	2	1						1	
Kentucky	5	3		3	1				
Louisiana	15	11		9	4	2	2		
Maine	19	13	1	8		9	5		
Maryland	5	2		1			1		
Massachusetts	41	3	1					1	1
Michigan	37	11		3	3	2	2		2
Minnesota	12	9		2		4	6		
Mississippi	8	8		6		2	2		
Missouri	6	2					1		
Montana	1	1		1					
New Hampshire	19	5		2	2				1
New Jersey	26	5					3		1
New Mexico	1	—							
New York	59	16	1	1	2	2	4	2	5
North Carolina	16	10		6	1		3	2	
Ohio	38	11		1	2		4	1	3
Oklahoma	7	4		1	1		1		2
Oregon	21	18	2	7	2	3	9		1
Pennsylvania	44	8	1	4			2		1
Puerto Rico	1	1			1			1	
Rhode Island	—	1					1		
South Carolina	10	8		6	2	2	2		
Tennessee	15	9		2	2	1	4	2	1
Texas	16	10		7		1	4	1	
Vermont	8	1				1			
Virginia	15	11		6	3		5	1	
Washington	17	16	4	9	3	2	4		
West Virginia	2	—							
Wisconsin	48	29	7	5	2	6	4	2	5
U.S. Sub-total	**668**	**302**	**20**	**150**	**38**	**42**	**90**	**15**	**31**
CANADA									
Alberta	3	2		3					
British Columbia	10	22	1	25		5	3		
Manitoba	4	3	1	1		2			
New Brunswick	6	10	4	4	2	4	2		
Newfoundland	3	3	2	1		2	3		
Nova Scotia	4	5	2	1		3	2		
Ontario	32	23	7	11	3	10	4		3
Quebec	53	39	18	13	1	21	12		2
Saskatchewan	—	1		1					
Canada Sub-total	**115**	**108**	**35**	**60**	**6**	**47**	**26**	**0**	**5**
U.S. and Canada Total	**783**	**410**	**55**	**210**	**44**	**89**	**116**	**15**	**36**

Notes: 1. Integrated mills producing both pulp and paper are counted twice, once as a pulp mill and once as a paper mill. 2. Pulp mills producing two or more different types of pulp are counted only once, and mills that do not report which grades they produce are also counted. Therefore the breakdown by types of pulp mills may not add up to the number of pulp mill sites. 3. Closed or idle mills are included in the tabulations.

*Molded pulp products are not included in these tabulations.

†Includes refiner mechanical pulp (RMP), thermomechanical pulp (TMP), chemimechanical pulp (CMP), and defibrated woodpulp.

Source: Post's Pulp & Paper Directory (1985).

housing cycle, which tends to be countercyclical to the pulp industry. The housing downturn in 1980 choked off the flow of byproduct residuals of Pacific Northwest sawmills at a time when pulp production was strong, and this triggered a sharp rise in chip costs. As a result, some pulp and paper mills in the region are now trying to chip more low-value logs. There is also increasing competition for wood residuals in all parts of the U.S. from new structural panel plants (oriented strandboard, waferwood) and from industrial energy users.

MAJOR PULPING PROCESSES

There are five major pulping processes used by North American pulp mills: (1) **sulfate** (kraft), (2) **sulfite**, (3) **semichemical**, (4) **mechanical**, and (5) **defibrated**. Each of these processes produces a different quality and yield of pulp from wood. The mechanical and defibrated processes produce low-quality pulp—low in strength, that is, but high in yield. Semichemical pulp, which is principally produced from hardwood, is an intermediate-quality pulp at medium levels of yield, 60% to 80%. The chemical pulps have the highest quality of pulp but their yields are lowest, 45% to 55%.

Within each pulping group there are major modifications. For example, in sulfate pulping there are high-yield pulps and low-yield pulps. In mechanical pulping processes, pulp can be produced by at least five modified pulping processes. Besides these processes, there are two minor chemical pulping processes used: the soda process and the prehydrolyzed sulfate process. The soda process has a soda cook, uses either sodium hydroxide or soda ash, and produces a medium-quality chemical pulp from hardwood species. The prehydrolyzed sulfate process produces a dissolving pulp (chemical cellulose) from either hardwoods or softwoods, and these are used to produce rayon, acetate, cellophane or chemical cellulose products.

In recent years, a few U.S. and Canadian producers have adopted a new extension of the pulping process, called **oxygen pulping or delignification**. Oxygen delignification is used to remove additional lignin from an alkaline-treated pulp after kraft or soda pulping. The process involves an oxygen reactor vessel located after brownstock washing and before the bleaching sequence.

A direct result of this pulping technique is a large reduction in the total amount of effluent which the conventional bleach plant would normally produce. Since the lignin content leaving the reactor is substantially less than in the conventional process, less bleaching chemical is required in the bleachery. Therefore, most producers use the oxygen pulping stage

U.S. WOODPULP CAPACITY TRENDS

(000 short tons)

	Total all grades	Dissolving & special alpha	Total sulfite[1]	Bleached* softwood sulfate[2]	Bleached* hardwood sulfate[2]	Unbleached sulfate	Semi-chemical[3]	Mechanical	Screenings
1986e	60,184	1,604	1,728	13,159	9,847	21,472	4,659	6,199	30
1985e	59,640	1,604	1,727	13,011	9,592	21,416	4,644	6,128	30
1984e	58,497	1,604	1,717	12,540	9,151	21,222	4,632	6,114	30
1983	57,690	1,604	1,743	12,229	8,877	21,232	4,587	5,900	30
1982	57,638	1,606	1,780	12,052	8,705	21,435	4,734	5,780	34
1981	56,831	1,598	1,855	11,757	8,559	20,972	4,597	7,434	58
1980	55,214	1,590	1,909	11,339	8,356	20,288	4,601	7,069	61
1979	53,636	1,551	2,004	10,897	8,078	19,923	4,553	6,572	63
1978	52,714	1,573	2,095	10,442	7,729	19,732	4,572	6,507	65
1977	51,849	1,648	2,525	10,048	7,322	19,552	4,514	6,442	71
1976	50,547	1,571	2,417	9,355	7,227	19,293	4,402	6,204	78
1975	49,502	1,671	2,420	9,025	7,208	18,758	4,246	6,090	84
1974	48,995	1,824	2,401	8,923	7,138	18,451	4,233	5,930	97
1973	48,459	1,754	2,378	8,842	6,936	18,475	4,171	5,802	100
1972	46,760	1,756	2,353	8,971	6,093	17,702	3,937	5,813	137
1971	45,731	1,772	2,414	8,266	6,008	17,091	3,814	4,680	156
1970	44,725	1,736	2,490	7,798	5,781	16,811	3,811	4,799	154

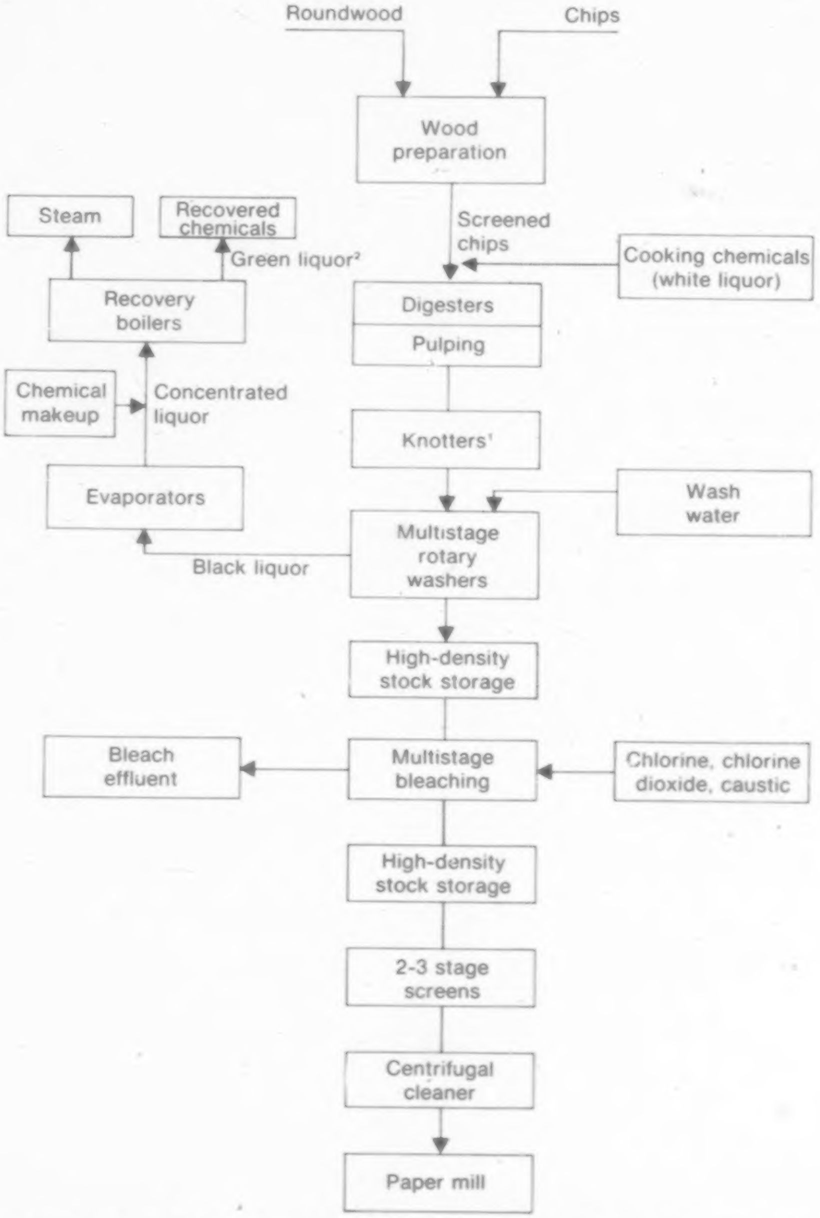
e = Estimate.

* Includes soda pulp.

1. Mainly bleached; unbleached sulfite capacity in 1983 was 400,000 tons.
2. Includes semibleached (1.5 million tons in 1977, the last year for which data were available).
3. Bleached semichemical capacity in 1983 was 361,000 tons.

Source: American Paper Institute.

SIMPLIFIED PROCESS FLOWS FOR KRAFT PULPING


Roundwood
Chips
Wood preparation
Screened chips
Cooking chemicals (white liquor)
Steam
Recovered chemicals
Green liquor[2]
Recovery boilers
Digesters
Pulping
Chemical makeup
Concentrated liquor
Knotters[1]
Evaporators
Wash water
Multistage rotary washers
Black liquor
High-density stock storage
Bleach effluent
Multistage bleaching
Chlorine, chlorine dioxide, caustic
High-density stock storage
2-3 stage screens
Centrifugal cleaner
Paper mill

[1] Some kraft mills use a hot stock refining system before washing. These systems use a refiner to defibrate the unbleached pulp after pulping. The defibrated pulp is then screened bfore washing

[2] Green liquor from recovery is treated in the causticizing process to process white liquor.

as a first bleaching stage, but variations have been employed. There are four such units operating in the U.S. and 26 worldwide, representing about 5.3 million metric tpy of capacity.

The use of **anthraquinone** as a catalyst in kraft and soda pulping has been developed by Canadian Industries Ltd. of Montreal. Mill trials have shown that this organic chemical, when applied in a ratio of about 0.10% to 0.15% to softwood in kraft pulping, typically improves yield by 2% to 3%, reduces alkali consumption by 10% to 15% and shortens cooking time. The AQ apparently speeds up the removal of lignin, allowing the pulp to retain more hemicelluloses.

Since receiving approval by the FDA in 1980 for its use in pulping, perhaps a dozen North American mills have been using AQ on a fairly regular basis, while many more are still conducting mill trials. It will probably take a few more years to determine whether AQ will come into widespread use. Domestic manufacturing capacity for the chemical must be expanded to improve its cost and availability, but chemical suppliers are waiting to see if a market for AQ develops.

BLEACHING SEQUENCE

Bleaching of woodpulp is required to improve whiteness. Whiteness or brightness is measured optically by testing instruments that indicate brightness points (such as GE, ISO or ELRDER units). Bleaching is accomplished by either oxidizing or reducing chemicals. The major oxidizing chemicals are chlorine, hypochlorites, chlorine dioxide and peroxide. Reducing chemicals are primarily hydrosulfites, principally sodium hydrosulfite.

Chemical pulp is bleached in large multistage bleaching processes by sequential chemical and washing treatment. For kraft pulp, a typical bleaching sequence might be chlorine, caustic, chlorine dioxide, caustic and chlorine dioxide (commonly represented as the CEDED process). Other common bleaching stages are peroxide (P) or hypochlorite (H). Other chemicals may be added in each stage to make the bleach plant more efficient in reducing production cost or producing a certain grade.

An example of this practice which is becoming popular today is oxidative extraction. This technique uses oxygen mixed with the pulp before the first extraction stage to reduce bleaching chemicals further downstream in the bleach line. Fully bleached chemical pulps have brightnesses in the 85-90 GE range. Semibleached pulps average 70-80 GE.

Reductive bleaching is used for brightening groundwood and deinked pulps. Some oxidating agents such as peroxides, chlorine, and hypochlorites are also used. These pulps brighten to only 55-65 GE and many times this is done in one stage of bleaching. Some producers do use multistage bleach lines for higher brightness points.

SULFATE OR KRAFT PROCESS

The sulfate or kraft process is the most widely used process for the pulping of wood. Since 1950 sulfate has grown from 38% to 66% of total North American pulp capacity. There are currently about 170 kraft mills in the U.S. and Canada, with a combined capacity in 1984

U.S. CONSUMPTION OF FIBROUS MATERIALS IN PULP, PAPER AND BOARD MANUFACTURE[1]

(000 short tons)

	1982	1981	1980	1979	1978	1977	1976	1975	1974	1970
Woodpulp, total	48,836	52,779	51,804	51,577	49,694	49,132	47,541	42,431	48,341	43,192
Wastepaper[2]	12,436	12,872	12,583	13,012	12,481	12,103	11,874	10,367	12,098	10,594
Mixed	1,901	2,165	2,686	2,889	3,149	3,001	3,009	2,761	3,332	3,393
News	2,575	2,417	2,116	2,131	3,149	3,001	3,009	2,761	3,332	3,140
Corrugated	5,613	5,919	5,628	5,737	5,187	4,839	4,618	3,950	4,669	3,511
High-grade pulp substitutes	1,211	1,380	1,302	1,401	1,338	1,403	1,323	1,142	1,427	1,377
High-grade deinking	1,136	991	851	854	786	784	771	650	615	493
Other (straw, rags, bagasse, etc.)	334	451	556	681	779	785	700	587	792	780
Cotton linter pulp	65	58	49	47	46	40	42	37	37	46

1. Woodpulp is also consumed in many nonpaper and board products, such as chemical cellulose, molded pulp products, etc.
2. Census data for wastepaper consumption are lower than those reported by American Paper Institute. See section on Wastepaper.

Source: Bureau of the Census.

of 50 million metric tons. Of this, U.S. mills accounted for 39 million, Canadian mills about 11 million tons.

In this alkaline process, woodchips are cooked under high pressures and temperatures in a solution of sodium hydroxide and sodium sulfide, a solution called white liquor. Woodchips are pulped in large pressure digesters either by batch or continuous processes for one to two hours in a solution of white liquor at temperatures in excess of 170°C (338°F). Depending on the quality of pulp desired, the amount of alkali, cooking time and temperature are varied to produce a pulp of high or low yield on wood. The higher-yield pulps have a higher lignin content and are normally used for such grades as linerboard and the coarser grades of kraft papers. If a pulp is to be bleached, the kraft pulping stage uses stronger conditions to reduce the pulp's lignin content. Since softwood pulps tend to be higher in lignin than hardwood pulps, more chemical is required to cook the pulp to a given lignin content.

The kraft process is a very versatile one. It produces good-quality pulps from nearly all hardwood and softwood species, its chemicals can be recovered economically in a straightforward recovery process, the technology is well understood, and it produces a strong, easily bleachable fiber. The kraft process is also rather attractive from an economic standpoint since the waste material, called black liquor, can readily be washed from the pulp, concentrated, and burned for recovery of energy and chemicals. A well-designed linerboard mill can be 50% or more self-sufficient in energy by burning the waste liquors.

However, the kraft process has certain deficiencies: (1) capital requirements for constructing kraft pulp mills are extremely high (more than $500,000/annual ton) and the mills must be built with corrosive-resistant metals since the liquors from this process are very corrosive; (2) odor pollution, principally from the sulfur compounds emitted during pulping and recovery is a serious problem, but most of these odor emissions can be controlled with modern pollution-abatement procedures; (3) the yield of the pulp in the sulfate process is rather low (45% to 55%); (4) explosions caused by molten smelt coming into contact with water present a safety hazard. Nonetheless, the sulfate process will probably continue to be the predominant pulping process for the foreseeable future, and it is unlikely that any new chemical pulping process will surpass the advantages of the sulfate process.

SULFITE PROCESS

Acid sulfite pulping is the oldest chemical pulping process used in North America, but its use has been declining. While U.S. and Canadian kraft pulp capacity

CANADIAN PRODUCTION OF WOODPULP

(000 short tons)

	Total all grades*	Dissolving & special alpha	Bl. sulfite	Unbl. sulfite	Bl. hardwood sulfate	Bl. softwood sulfate	Semi-bleached sulfate	Unbl. sulfate	Semi-chemical	Ground-wood
1983										
1982	17,791	219	319	1,403	810	5,125	879	1,465	312	7,217
1981	20,261	274	488	1,769	805	5,473	1,009	1,921	392	8,085
1980	20,303	271	463	1,671	794	5,786	1,185	1,998	345	7,748
1979	20,331	311	478	1,806	811	5,471	1,038	2,061	354	7,956
1978	19,783	341	516	1,787	785	5,086	1,054	1,942	318	7,910
1977	17,925	230	636	1,621	680	4,620	1,039	1,574	263	7,226
1976	17,687	222	609	1,649	594	4,672	1,038	1,559	269	7,037
1975	14,850	226	516	1,442	452	3,767	863	1,314	233	6,007
1974	19,359	333	734	1,865	777	4,632	1,096	1,942	329	7,588
1973	18,218	293	507	1,750	893	4,155	1,097	1,922	350	7,196
1972	17,123	370	526	1,711	835	3,556	1,127	1,639	337	6,967
1971	16,235	388	587	1,706	723	3,130	1,150	1,467	301	6,718
1970	16,350	411	684	1,870	3,660†		1,084	1,341	285	6,940
1965	13,050	431	817	1,836	1,862		566	1,114	177	6,170
1960	10,255	356	519	1,560	1,062		257	895	203	5,335
1955	9,082	265	566	1,625	663		55	617	141	4,960
1950	7,606	305	386	1,315	396		12	548	94	4,445

* Excludes defibrated and exploded pulp (260,000 tons in 1982) used mainly in construction grades; about 30,000 tons of screenings are included.

† Total bleached softwood and hardwood production.

Source: Canadian Pulp & Paper Assn.

more than quadrupled from 1950 to 1984, sulfite capacity remained almost flat over this period, totaling 3.6 million short tons in 1984. Of this, about 1.5 million tons was produced in the U.S. and 2.1 million tons in Canada, representing about 60 mills.

The sulfite process uses an acid solution of sulfurous acid and bisulfite salts with high temperatures to dissolve the binding lignins holding the fibers together. Pulping is done in large batch digesters, for periods of six to nine hours, depending on the quality of the pulp. A wide range of yields can be produced by the sulfite process. High-yield sulfite (normally called bisulfite pulp) is used for newsprint, and it has yields of about 55%, whereas chemical-grade acid sulfite pulp has much lower yields, in the range of 45%.

A number of different chemical bases are used to produce sulfite pulps. Originally the sulfite pulping process used a calcium base; however, it was difficult and uneconomical to recover the spent liquors from this process. Today sulfite processes are based not only on calcium but also on ammonia, sodium, and magnesium. The sodium- and magnesium-based processes offer full chemical recovery, whereas in the ammonia-based process the liquor is burned for energy but its ammonia or nitrogen values are not necessarily recovered. However, the sulfur dioxide from this process can be recovered.

Chemical-grade sulfite pulps find use in fine papers, tissue papers, bristols and other high-quality papers. But sulfite pulps produced from either softwoods or hardwoods have poorer strength properties than their equivalent sulfate pulps. This has prevented their use in areas where high strength is required, linerboard, bag and sack papers, for example.

Among other factors which have caused sulfite to decline from 9% of total North American pulp production in 1950 to only 5.7% in 1981 have been limitations in wood species that can be used, the age and small size of many mills, and the slow development of recovery technology.

SEMICHEMICAL PULPING

Semichemical pulping was developed in the late 1920s at the Forest Products Research Laboratory in Madison, Wis., for the pulping of hardwoods, which were then not used extensively for pulp fiber. Semichemical pulping uses a mild chemical pulping of chips prior to mechanical defibrating. The semichemical pulp produced has a fairly high yield, 60% to 80%, and an intermediate strength level. This pulping process is used principally for pulping hardwood chips, but softwood chips and sawdust can also be used. Hardwood fibers pulped by the semichemical process produce an excellent pulp for corrugating medium, a grade in which this process finds its main use.

The original semichemical process was the **neutral sulfite semichemical** process (NSSC). This process pulps hardwood chips in a solution of sodium sulfite at an alkaline pH. To buffer the acids formed during pulping, soda ash is added. When NSSC pulping was first practiced, it was accomplished in rotary digesters using

CANADIAN WOODPULP CAPACITY

(000 metric tons)

	Total* all grades	Dissolving & special alpha	Bl. sulfite	Unbl. sulfite	Bl. softwood sulfate	Semibl. softwood sulfate	Bl. hardwood sulfate	Unbl. sulfate	Semi-chemical	Mecha-nical
1986e	23,697	227	489	1,551	6,818	1,171	1,140	1,774	474	10,053
1985e	23,630	222	487	1,583	6,677	1,170	1,184	1,772	474	10,051
1984e	23,443	214	461	1,640	6,681	1,174	1,158	1,760	466	9,889
1983	22,377	201	457	1,734	6,492	1,169	1,121	1,722	462	9,519
1982	22,618	305	436	1,950	6,336	1,236	988	1,759	445	9,163
1981	22,424	303	461	2,119	6,371	1,106	955	1,788	445	8,876
1980	21,864	307	426	2,062	6,252	1,198	879	1,712	438	8,550
1979	22,521	395	512	2,100	6,114	1,258	866	1,807	459	9,010
1978	22,014	424	580	2,091	5,699	1,216	852	1,824	455	8,837
1977	22,251	353	727	2,119	5,535	1,191	848	2,062	454	8,924
1976	22,242	408	807	2,134	5,329	1,189	860	2,157	426	8,894
1975	21,960	427	794	2,131	5,256	1,203	877	2,132	400	8,696
1974	21,641	404	689	2,144	5,027	1,264	867	2,087	390	8,716
1973	20,957	416	622	2,107	4,851	1,249	844	1,967	392	8,652

e — Estimate.

* Includes screenings; excludes mechanical pulp for construction paper and board.

Source: Canadian Pulp & Paper Assn.

GENERAL DESCRIPTION OF COMMERCIAL PROCESSES FOR PULPING WOOD

Pulp classification	Name of process	Process description	Woods used	Yield of pulp by weight, bl/unbl (%)	Strength of pulp (a)	Pulp usage	Final products	U.S. capacity 1984 (000 short tons)	Number of pulp mills in U.S. 1982 (b)
Dissolving	Prehydrolyzed kraft	Woodchips first receive an acid or water hydrolysis to remove pentosans and then are pulped via kraft process. Very high alpha grades receive a cold caustic treatment after kraft pulping	Softwoods: Southern pine Hardwoods: Gum, oak, southern mixed hardwoods	30-35	Low	Chemically converted into chemicals, plastics, rayon, cellophane, or acetates		650	3
	Sulfite	Woodchips first are pulped under special acid sulfite pulping conditions. Higher purity achieved via pressure heat treatment or cold caustic treatment stages	Softwoods: Southern pine, hemlock, spruce Hardwoods: Eastern	30-35	Low	Same as above		950	6
Chemical (c)	Kraft	Woodchips reduced under steam pressure to pulp with alkaline chemicals (sodium hydroxide and sodium sulfide)	Softwoods	42-55	Softwoods high to very high, Hardwoods medium to medium-high	Higher yield pulp used for container board. Lower yield pulp used for numerous grades of paper. Often mixed with other pulps	Strong wrapping and bag paper containerboard book, newsprint, lightest grade magazine and other printing papers, bond, writing	42,513 total Bleached & semibl softwood--12,540 hardwood--9,151	125
			Hardwoods	44-49					
	Sulfite	Woodchips reduced under steam pressure to pulp with an acid chemical (calcium, magnesium, sodium, or ammonium bisulfite plus sulfurous acid)	Softwoods: spruce, balsam, hemlock, southern pine Hardwoods: Eastern Lake States	44-49	Softwoods medium to high	Usually mixed with other pulps. When purified used for special products	Book & magazine Wrapping Tissue Newsprint Glassine writing Cellulose derivatives	1,717	27

GENERAL DESCRIPTION OF COMMERCIAL PROCESSES FOR PULPING WOOD, continued

Pulp classification	Name of process	Process description	Woods used	Yield of pulp by weight, airdried (%)	Strength of pulp (a)	Pulp usage	Final products	U.S. capacity 1986 (000 short tons)	Number of pulp mills in U.S., 1986 (a)
Chemical, cont.	Soda	Woodchips cooked under steam pressure to pulp with an alkaline chemical (caustic soda)	Mostly Hardwoods: Aspen Cottonwood Basswood Beech Birch Maple Tupelo (gum) Oak	50-60	Medium to medium low	Often mixed with sulfite and other pulps	Book and magazine, lithograph, other printing papers, envelope, blotting paper	212	2
Semichemical	Neutral sulfite, bisulfite, acid sulfite, kraft, soda or caustic	Woodchips partially softened under steam pressure with chemicals and reduced to pulp by mechanical action.	Hardwoods: Same as for soda pulp, Red alder, [illegible] Softwoods: Small amounts of Douglas-fir, ponderosa pine and sugar pine	60-80	Medium to medium low	Alone in corrugating & some other boards. Bleached pulps mixed with softwood pulps for other products	Corrugating board, food & other specialty boards, glassine, magazine, newsprint, insulating & sheathing board	4,832	38
Semi-mechanical	Mason (exploded) Asplund (defibrated)	Woodchips treated with steam or hot water at high temperatures and pressures to soften the wood followed by mechanical fiberization	Softwoods and hardwoods	80-90	Low to very low	Coarse pulps composed of mixture of single fibers and fiber bundles used alone and mixed with other pulps	Hardboard, insulating, roofing and flooring felts	864	12
	Cold soda	Woodchips given cold treatment with sodium hydroxide solutions and then mechanically fiberized to pulp	Hardwoods: Birch, maple, aspen, oak, cottonwood, [illegible] Regional Often [illegible]	85-90	Medium to low	Often mixed with other pulps	Printing paper	286	6

GENERAL DESCRIPTION OF COMMERCIAL PROCESSES FOR PULPING WOOD, continued

[illegible]	[illegible]	Process description	Woods used	[illegible]	[illegible]	Pulp usage	Final products	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

batch techniques. With the development of continuous digesters such as the Pandia, M&D and Defibrator, most NSSC pulp mills adopted continuous pulping. In continuous digesting retention time is very short, normally not over 15 minutes at temperatures in excess of 170°C (338°F). The spent chemicals and organic materials are either washed or pressed from the pulp, and are either burned in a fluidized-bed incinerator or in specially designed incinerators or recovery units such as Copeland's recovery unit.

A **nonsulfur** based semichemical process was developed in the late 1960s by Owens-Illinois. This system uses a solution of sodium hydroxide and soda ash to produce a semichemical pulp equivalent in quality to NSSC pulp. It is adaptable to existing processes with only minor modifications. About 50% of the NSSC producers have shifted to the no-sulfur, soda-based cook.

MECHANICAL PULPING

In the mechanical process, pulpwood, used in the form of roundwood or chips, is converted to pulp by mechanical energy. The first process used, and still the predominant one, is the **groundwood** process in which short logs are fed against a rotating disc called a grinder, which grinds off fibers and bundles of fibers which are then cleaned with water into a chest beneath the grinder. Since, at the interface of the grinder and the log, high temperatures are created, there is a plasticizing effect on the lignin and this reduces the energy required to loosen the fibers from the wood matrix; this also prevents excessive damage to the fiber. The fibers produced by grinding are short or chunky but of a very high yield (>90%). These pulps are further refined with refiners to remove slivers or bundles and to develop some strength properties.

Groundwood pulps are ideal for bulky sheets requiring good opacity — newsprint and low quality printing grades. Obviously they have poor sheet strength, and because of this some kraft or high yield sulfite pulp has to be added to grades such as newsprint to give them enough strength to run on paper machines and printing presses. Groundwood pulp capacity in the U.S. and Canada for paper and board production is about 9.2 million metric tons.

Since grinders must accept logs, it is impractical to use chips for producing mechanical pulps. In the early 1960s, it was discovered that chips could be refined, with or without preheating, in large disc refiners which discharge to the atmosphere. The resulting pulps tend to be of longer fiber lengths than groundwood/untreated pulps from the same species. Consequently they have somewhat better strength but also a slightly lower opacity. This process is called **refiner mechanical pulping** (RMP), and it opened the way for many mills, especially in the Pacific Northwest, to use residual chips for the production of mechanical pulps.

In the late 1960s it was learned that if chips were preheated and refined under pressure in a disc refiner, a much higher quality of pulp could be obtained. This process, called **thermomechanical pulping** (TMP), has allowed mills to produce a stronger pulp than hitherto thought possible from mechanical processes. In a typical TMP process, softwood chips are presteamed at 110°C (230°F) for one or two minutes, fed via a press feeder or through a pocket feeder into a pressurized refiner having especially designed plates, and then are released under pressure to a stock chest. These pulps are then further refined in a second stage.

DESCRIPTIONS OF MECHANICAL PULPING PROCESSES

Groundwood pulp (GW) Groundwood produced by atmospheric grinding of logs with a conventional stone grinder.

Pressurized groundwood (PGW) Groundwood produced by grinding logs in a pressurized atmosphere with a conventional grinder.

Groundwood from chips (FGP) Groundwood produced by atmospheric grinding of chips with a modified grinder. There is no common abbreviation: the FGP is used by the Japanese inventors - F for fine, and GP for groundwood pulp.

Refiner mechanical pulp (RMP) Atmospheric refining of untreated chips.

Chemirefiner mechanical pulp (CRMP) Atmospheric refining of chemically treated chips.

Chemi[illegible] mechanical pulp (CTMP) Produced from chips pr[illegible]ed with chemicals prior to steaming, then refined in pressurized refiner, with or without subsequent pressurized or atmospheric refining stages.

Thermomechanical pulp (TMP) Produced from chips first presteamed and refined in one or more stages of pressurized refining, or followed by atmospheric refining.

Sodium sulfite-treated TMP (Opco TMP) Process developed by Ontario Paper Co. which involves treating (cooking) TMP pulp (rather than chips before refining) with sodium sulfite.

Sulfonated chip mechanical pulping (SCMP) Patented process of CIP Inc. which is basically chemical pretreatment of chips followed by atmospheric refining. Abitibi-Price and Consolidated-Bathurst both have variations of this process. C-B refers to its process as "Ultra High Yield (UHY)," but this process might be called sulfite pulp or CRMP.

Tandem TMP Refers to an arrangement of refiners, for example, single stage only (pressurized), two stages (first only pressurized), three stages (only first pressurized).

Within the last ten years a number of modifications of the TMP process have been made. Some of these processes use chemicals (usually sodium sulfite at various pHs) before and after the TMP stage; others use steaming and nonpressurized first-stage refining, and others use no steaming and pressurized refining (see table showing definitions). Some success has also been reported at a Swedish mill having single-stage TMP refining. TMP pulp is finding wide use in newsprint, coated publication papers, and a few other specialized paper and board grades. When TMP is used in newsprint grades, mills are able to reduce the chemical pulp content in newsprint furnish.

TMP is the fastest-growing pulping process and there are now around 5.8 million metric tons of capacity in the U.S. and Canada, and growth is expected to continue. The main drawback to TMP is its high energy requirement, although methods are being found to improve heat recovery. But TMP now represents 37% of total mechanical pulp capacity in North America for paper and paperboard production, up from virtually nothing a decade ago.

Groundwood pulping has been declining, but one recent innovation has been **pressurized groundwood** (PGW) pulping, developed in the late 1970s by Tampella of Finland. The pulp produced by this process has strength values approaching those of TMP with only two-thirds of the power consumption, or about the same amount of power as required by conventional groundwood. PGW is now being used at more than 10 mills in Europe, South Africa and the U.S. (where Madison Paper Co. installed four grinders for a new supercalendered paper machine in Maine).

A new method of producing conventional groundwood pulp that permits use of chips has been developed by Oji Paper Co. of Japan, and is in commercial operation at its Tomakomai mill.

DEFIBRATED PULP PROCESS

This is the simplest way of preparing pulp and it gives the highest yield with less pollution, but obviously the pulp has very poor strength characteristics. Defibrated pulp can be prepared from either softwoods or hardwoods depending on the products produced or the timber available. The first process used to prepare what we now call defibrated pulp was the Masonite process, which steams chips under pressure in a vessel and releases them via a gun or nozzle to atmospheric pressure. The explosion literally blows the pulp into individual fiber masses which are then mixed to make a pulp slurry. This slurry can be used to make coarse grades of paper and board with little or no extra refining. It is ideally suited for making insulation and hardpressed board, and its major use today is still for these products.

In the late 1930s, Defibrator of Sweden developed the defibrated pulping process. In this process, pulp is fed continuously to a preheating vessel under slight pressure and reasonably high temperature, and discharged through a pressurized refiner at the bottom or end of the pulping vessel, where it is defibrated under pressure. The pulp is then discharged to atmospheric pressure to either a live-bottom storage bin or to a stock chest where it is diluted to make a stock slurry. If required, this pulp is again refined, principally to break up fiber bundles and to develop some strength characteristics, and then it is fed to either a cylinder- or fourdrinier-type former.

If the fiber from this process is to be used in a dry process such as for producing hardpressed board, it is not diluted with water but is stored in a live-bottom bin and then fed through a distributor line onto a forming wire. The capacity for making defibrated pulp has grown rapidly during the last 20 years.

DEINKING PROCESS

Deinking is the process of removing inks and in some cases coating and filler from wastepapers, principally newspaper and coated ledgers.

Deinking is primarily practiced at nonintegrated paper mills, and is carried out by two processes: (1) flotation and (2) washing. In the washing system, wastepaper is pulped with chemicals (soda ash, caustic soda, sodium silicates, surfactants, or solvents) in an open pulper either on a continuous or batch basis. The pulp is washed free of ink on conventional rotary washers or on side-hill screens. The washed pulp is then screened and bleached.

Flotation deinking uses air to float off ink particles

THERMOMECHANICAL PULPING CAPACITY TRENDS IN U.S. AND CANADA

(000 short tons)

	Canada	U.S.	Total
1986e	4,601	2,461	7,062
1985e	4,226	2,395	6,621
1984e	3,962	2,389	6,351
1983	3,456	2,190	5,646
1982	2,926	2,048	4,974
1981	1,645	1,723	3,368
1980	1,229	1,371	2,600
1979	790	872	1,662
1978	600	719	1,319
1977	607	567	1,174
1976	417	333	750
1975	76	131	207

e = Estimate

Source: Canadian Pulp & Paper Assn. and American Paper Institute.

from the fibers. In flotation deinking, the wastepaper is first sent to a pulper with deinking chemicals, cleaned with screens and centrifugal cleaners and then deinked with flotation cells. Typical chemicals used are sodium peroxide, silicates, foamers (a soap), and a collector.

There are currently more than 50 mills in North America deinking wastepaper. More than 45 of these are in the U.S. and five are in Canada. Tissue mills (about 20 installations) account for nearly half of the mills that are deinking. Fort Howard Paper Co. is a leader in producing deinked tissue using proprietary technology to process less expensive wastepaper grades. About a dozen mills use deinked fibers for printing and writing grades, four for liner and boxboard, and seven for newsprint. Garden State Paper Co. is the leading U.S. producer of recycled newsprint. Several small U.S. mills owned by Ponderosa Fibres of America produce deinked market pulp.

In addition to the two main systems, flotation and washing, several other deinking systems are also used. There are three combination systems which have a washing system coupled with a flotation unit to clean the effluent off the washers.

Regardless of the type of system, the pulper is usually run batch, while the deinking line draws from a storage tank and is run continuously. Systems at Bergstrom Paper Co., Marcal Paper, Southwest Forest Industries, and Perkins Paper Co. are notable exceptions. These systems take pulp out of the pulper continuously and run the deinking line continuously.

Riverside Paper Co. has a unique solvent-extraction system that is used on wastepaper stock such as cupstock, milk carton stock and other difficult-to-clean waste.

WASTEPAPER

Wastepaper—also called paper stock, recyclable paper and secondary fiber—is used as a lower-grade fiber alternative to virgin pulp in the manufacture of paper and paperboard. Though usually less expensive than virgin pulp, secondary fiber is not as popular because it produces a weaker product, among other quality-related considerations.

The percentage of recyclable paper used in overall fiber furnish in the U.S. has remained relatively stable since 1979 at about 23%, though it has continued to rise overall with only minor setbacks, according to the American Paper Institute.

In 1980, wastepaper supplied 22.8% of the furnish at U.S. pulp and paper mills, decreasing to 22.7% in 1981 but rising again to 23.2% in 1982 and 23.6% in 1983. Wastepaper is expected to supply 23.9% of overall fiber furnish in 1984 and 24.1% in 1985.

Wastepaper utilization—the ratio of wastepaper used in proportion to the total paper and paperboard produced—has also varied only slightly in the past decade. Since 1965 it has remained at about 23%. In 1979 it stood at 23.7%, increasing to 24% in 1980 and 1981. By 1986 it is expected to go up slightly to 24.2%, far below the record 35% set in 1944 (mid-World War II).

Data Resources Inc., the Lexington, Mass., market research firm, expects the wastepaper utilization rate to remain at 24.2% in the U.S. until 1993, when the rate in Western Europe will be 45% and in Japan, 40%.

Aside from slightly increased utilization rates and ratios of usage in overall fiber furnish, another encouraging sign for the wastepaper market in 1983 was record U.S. mill consumption of 15.99 million short tons of paper stock, breaking 1981's record of 15.56 million tons.

Demand at the beginning of 1984 seemed to presage even better demand for secondary fiber in the near term. API vice president of paperboard, J. Rodney Edwards, said during the API Paper Week convention in March 1984 that if paper stock utilization continued at its early 1984 rate, collection of wastepaper for recycling could be over 20 million tons in 1984.

According to Franklin Associates Ltd. in a 1982 report entitled *Wastepaper, the Future of a Resource*, the use of recycled fiber will increase from 15.1 million tons in 1980 to 20.2 million tons in 1990 and 25.8 million tons in 2000.

In paperboard, the use of wastepaper has risen in the unbleached kraft and semichemical grades but only slightly in the recycled paperboard grades. And, overall, the percentage of recycled fiber in paperboard has declined slightly, according to the Franklin study. This trend is likely to continue until 1990 and then reverse to the level of 1970.

The use of wastepaper in the production of some other grades, however, is on the decline, the study indicates. Construction grades are essentially a no-

WASTEPAPER CONSUMPTION IN U.S. MILLS AS REPORTED BY CENSUS AND API

(000 short tons)

	Census	API
1983	14,037	14,539
1982	12,835	13,565
1981	13,381	15,409
1980	12,583	14,922
1979	13,012	15,361
1978	12,586	14,760
1977	12,103	14,058
1976	12,616	13,622
1975	10,367	11,748
1974	12,098	13,982
1973	12,374	14,094
1972	11,703	12,925
1971	11,000	12,106
1970	10,594	11,803

Source: Bureau of the Census, M26A data; American Paper Institute, Statistics of Paper.

growth sector of the industry, and the increase in secondary fiber consumption at tissue and newsprint mills is expected to slow down in the 1980s.

CONSUMPTION MEASUREMENTS

The measurement of wastepaper utilization is calculated as a ratio of total paper and paperboard produced. Another indicator of wastepaper consumption is the amount of wastepaper used in relation to the total fiber furnish. The ratio of wastepaper to fiber furnish is slightly less than the utilization rate due to the loss of fiber in papermaking, which results in requiring slightly more than one ton of fiber to produce one ton of paper.

Data for wastepaper consumption is collected by the Dept. of Commerce and API in the U.S. and the Canadian government and Canadian Pulp & Paper Assn. in Canada. API's figures are generally higher than those from the Dept. of Commerce because API includes inplant and intraplant use of paper machine trim and broke and some consumption of wastepaper in construction grades, which may not be included in government statistics.

SUPPLY

Sources of wastepaper are generally broadly divided into pre- and postconsumer supplies. Preconsumer paperstock generators are primarily converting plants

WASTEPAPER AS PERCENT OF FIBER FURNISH IN U.S. PAPER/BOARD PRODUCTION

(000 short tons)

Year	Wastepaper	Total woodpulp, other fibers	Percent of wastepaper
1985p	17,799	73,859	24.1%
1984p	17,236	72,203	23.9
1983p	16,100	68,403	23.6
1982	14,620	63,060	23.2
1981	15,217	66,981	22.7
1980	15,094	66,122	22.8
1979	15,400	66,703	23.1
1978	14,760	68,780	21.5
1977	14,288	64,087	22.3
1976	13,822	61,904	22.3
1975	11,983	55,087	21.8
1974	14,196	63,326	22.4
1973	14,318	63,876	22.4
1972	13,132	61,164	21.5
1971	12,323	57,128	21.5
1970	12,021	55,823	21.5

p = Preliminary

Calculated by PULP & PAPER from American Paper Institute data

WASTEPAPER UTILIZATION BY GRADES

(000 short tons)

Year	Total	Mixed papers	%	Newspapers	%	Corrugated	%	Pulp subs*	%	Deinking	%
1986e	18,109	1,991	11	3,388	19	8,680	48	2,468	14	1,583	9
1985e	17,799	1,980	11	3,387	19	8,466	48	2,444	14	1,521	9
1984e	17,236	1,888	11	3,237	19	8,215	48	2,495	14	1,401	8
1983e	16,100	1,814	11	3,012	19	7,603	47	2,399	15	1,273	8
1982	14,620	1,707	12	2,673	18	6,770	46	2,247	15	1,224	8
1981	15,883	2,356	15	2,667	17	7,231	46	2,382	15	1,247	8
1980	15,094	2,268	15	2,564	17	6,866	45	2,254	15	1,142	8
1979	15,520	2,648	17	2,480	16	6,967	45	2,308	15	1,117	7
1978	14,760	2,729	18	2,212	15	6,721	45	2,242	15	1,068	7
1977	14,288	2,773	19	2,287	16	6,205	43	2,079	14	944	7
1976	13,822	2,798	20	2,278	17	5,696	41	2,117	15	933	7
1975	11,983	2,606	22	2,040	17	4,743	40	2,594*	22	—	-
1974	14,196	3,118	22	2,408	17	5,716	40	2,955*	21	—	-
1973	14,318	3,371	24	2,456	17	5,292	37	3,199*	22	—	-
1972	13,132	3,054	23	2,317	18	4,722	36	3,037*	23	—	-
1971	12,323	2,776	22	2,174	18	4,277	35	3,097*	25	—	-
1970	12,021	2,639	22	2,235	19	4,080	34	3,067*	25	—	-

* Pulp substitutes include deinking grades prior to 1976.

e = American Paper Institute estimate

Source: American Paper Institute Capacity Survey for relevant years, 1970-81.

that produce such products as containers, bags, envelopes, books and business forms. In the manufacture of these products, the plant normally generates waste from machine trims and other manufacturing operations. Postconsumer generators include residential homes, factories, offices and retail outlets.

Increasing amounts of wastepaper have been generated from the postconsumer segment since recycling became popular in the 1960s. Over 18 million tons of the 68 million tons of paper and paperboard that were used in the U.S. in 1981 were collected for recycling. This represents an overall recovery rate of 26.6% and an increase of 33% from the 12 million tons collected in 1970. In the decade 1970-79, the recovery rate ranged from 22% to 25%.

The collection system for each grade of wastepaper differs. Old newspapers are usually generated from the home and kept for donation to a local paper drive sponsored by a nonprofit group to raise money. In 1983, 3.4 million tons of old newspapers were collected for recycling, up 100,000 tons from the previous year, according to API.

The largest volume of old corrugated containers is generated from retail stores, factories and office buildings. Only one-fourth is supplied by preconsumer sources. API reports that 8.3 million tons of corrugated

WASTEPAPER RECOVERY FOR USE IN U.S. MILLS BY RANGE AND GRADE, 1980, 1990, 2000

(000 tons)

Grade	1980 (actual)	1990 (range)	2000 (range)
Mixed	2,268	2,400-2,800	2,600-3,000
News	2,564	2,700-3,950	3,130-5,250
Corrugated	6,866	9,000-10,240	11,430-14,310
Pulp substitutes	2,254	2,600-3,000	3,000-3,500
Deinking	1,142	1,600-2,120	1,900-2,770
Total	15,094	18,300-22,110	22,060-28,830
Utilization rate (%)*	22.8	21.1-25.4	20.3-26.5

*Ratio of wastepaper use to total fibrous raw materials use.

Source: Franklin Associates Ltd., "Wastepaper: the Future of a Resource: 1980-2000."

UTILIZATION OF WASTEPAPER BY U.S. PAPER/BOARD MILLS

(000 short tons)

Year	Wastepaper used*	Paper/board produced	Utilization rate (%)
1986e	18,109	74,866	24.2%
1985e	17,799	73,859	24.1
1984e	17,236	72,203	23.9
1983	16,100	64,403	23.5
1982	14,620	63,060	23.2
1981	15,409	64,496	23.9
1980	14,922	63,701	23.4
1979	15,361	64,594	23.8
1978	14,706	62,208	23.7
1977	14,058	60,207	23.3
1976	13,622	58,486	23.3
1975	11,748	51,126	22.9
1974	13,982	59,210	23.6
1973	14,094	59,936	23.5
1972	12,925	57,477	22.5
1971	12,106	53,023	22.8
1970	11,803	51,710	22.8

* Includes the following tonnage consumed in the manufacture of molded pulp products: 1982, 187,000 tons; 1983, 180,000 tons; 1984-86, 203,000 tons.

Source: Paper/board production totals and wastepaper utilization from American Paper Institute Capacity Survey for relevant years.

WASTEPAPER USAGE BY PAPER AND BOARD GRADE

(000 short tons)

Grade	1983	1985	1987	1989	1991	1993
Newsprint	1,231	1,401	1,369	1,614	1,660	1,943
Printing & writing	957	1,134	1,091	1,276	1,229	1,498
Packaging & indus.	330	389	364	417	389	469
Tissue	1,918	2,165	2,134	2,385	2,376	2,599
Kraft board	1,312	1,605	1,680	2,033	2,162	2,608
Semichemical board	1,393	1,666	1,650	1,905	1,894	2,227
Recycled board	7,609	7,951	7,249	7,861	7,216	7,791
Building papers	1,470	1,753	1,518	1,756	1,430	1,800

Source: Data Resources, Inc., "U.S. Secondary Fibre Study," 1983.

boxes were collected for recycling in 1983, 700,000 tons more than in 1982. The increase reflects greater utilization of recycled papers at containerboard mills.

Mixed papers are generated mostly from office buildings and are usually carted away by private haulers. During market slumps, haulers usually stop picking up mixed paper because, being the lowest and cheapest of the wastepaper grades, its price may drop to below a point where it pays to transport it. In 1983, 2.5 million tons of mixed papers were collected, 300,000 tons above the previous year's total, API reports.

More and more large office buildings, like corporate headquarters, are starting to collect office papers to reduce their waste disposal costs and make some money from the sale of wastepaper. Usually this is done by having employees sort their own office waste and carry it to a central collection point in the office building, where it is picked up by a private hauler. The increasing popularity of this practice, however, has not been sufficient to make it a significant factor in waste collection.

Collection of total high grades for deinking and pulp substitutes recycled in 1983 totaled 4.2 million tons, 500,000 tons more than in 1982. Printing and writing and tissue mills accounted for a good proportion of the increased demand for these grades, according to API.

Long-term projections call for collections of over 30 million tons of recyclable paper by the year 2000, but this estimate might be low considering the unexpected rise in demand early in 1984, according to API's Edwards.

DRI, in a 1983 study entitled *U.S. Secondary Fiber Study*, projects that the U.S. recovery rate for recyclable paper will grow substantially faster over the next 11 years than in the last ten years due to rising virgin pulp prices, improved pulping technology, rising real wood costs on the West Coast and rising emphasis on recycling.

The study indicates that total wastepaper recovered in the U.S. should reach 25.6 million tons by 1993, 50% more than the 17.1 million tons collected in 1982 and the 18.6 million tons collected in 1983. In that period, however, recessions forecast for 1987 and 1991 will cause a decline in recovery rates, the study notes.

Total U.S. wastepaper recovered is defined as total amount of wastepaper salvaged minus imports, according to DRI.

GRADES

Mixed papers, news, old corrugated, pulp substitutes and deinking are the five official wastepaper grade categories used by the Commerce Dept., and these are generally used in the industry to market wastepaper. In addition, the Paper Stock Institute of America, a division of the National Assn. of Recycling Industries Inc., subdivides the five classifications into more definitive grades.

U.S. WASTEPAPER EXPORTS TO MAJOR CONSUMING COUNTRIES, 1982-83

(000 short tons)

	News	High-grade deinking	High-grade pulp substitutes	Corrugated	All other	Total	Percent change
Korea							
1983	195.0	70.5	18.2	153.4	120.1	557.2	8.8
1982	159.7	48.2	17.0	163.5	123.6	512.0	
Canada							
1983	24.1	25.3	66.3	143.1	88.0	346.8	27.8
1982	25.2	29.1	63.0	85.5	68.6	271.4	
Mexico							
1983	96.4	56.1	46.5	205.8	68.2	473.0	100.1
1982	96.6	5.4	38.2	91.2	4.9	236.3	
Taiwan							
1983	96.6	27.2	13.8	170.4	236.4	544.9	17.9
1982	124.8	17.9	13.6	153.5	152.3	462.1	
Japan							
1983	26.2	12.4	28.6	81.0	118.0	266.2	151.5
1982	10.5	4.7	20.2	57.7	12.7	105.8	

Source: National Assn. of Recycling Industries Inc. from Dept. of Commerce.

These include 49 regular grades that comprise the bulk of the wastepaper traded in the U.S. and Canada, along with 32 specialty grades that are sold to a limited number of mills that have the capability to use them in their product mixes. These grades generally include contaminants, such as plastic coatings and foil, which restrict their use.

DEFINITIONS

- **Mixed paper:** paper of varied quality, often office waste; also, boxboard cuttings and mill wrappers
- **News:** old newspapers, either collected from households or over issued at newstands or inplant; also, groundwood paper trim
- **Old corrugated containers:** used corrugated containers; also, container plant cuttings
- **Pulp substitutes:** unprinted grades of brown and colored kraft, white and semibleached sheets and cuttings, tabulating cards and shavings or trim of unprinted grades
- **Deinking:** deinked grades of white and colored ledger, computer printout, coated book and groundwood paper, and bleached sulfate sheets and cuttings.

MARKETS

Cheapest of the wastepaper grades is mixed, which is used primarily in construction paper and board production, such as roofing felts and gypsum board. It is also used in manufacturing boxboard grades. The shift from paper-based roofing to fiberglass-based roofing felt has reduced demand for mixed papers, but an increase in housing starts has a substantial effect on demand for mixed papers used in gypsum board production.

The decline in construction in 1981-82 resulted in a severe glut in mixed papers during this period, causing a considerable amount to be taken to the landfill or sold for the cost of freight only.

By 1983, however, demand was growing and prices had escalated to as high as $30/ton in some areas due to the increased demand for building products both domestically and for export. NARI reported mixed paper export demand for the first eight months of 1983 increased in Canada by 40%; Mexico, up 1,500%; Japan, up 1,235%; and Taiwan, up 48%.

Linerboard and corrugated medium mills, the major users of old corrugated containers, consumed less wastepaper in 1981-82 due to the economic slump which reduced demand for packaging as consumer spending dropped off. By 1983, however, producers were beginning to worry about possible future shortages, based on projections for linerboard demand through the latter part of the 1980s.

Howard E. Ingram of Stone Container Corp. estimated kraft linerboard mills would operate at 100% of capacity by 1986, substantially affecting secondary fiber markets. Wastepaper consumption at these facilities has been on the upswing for many years (200,000 tons of OCC used in kraft linerboard manufacture in 1970 compared with 1.35 million tons in 1983), according to Ingram.

The old news market held up fairly well in the 1981-82 recession but did not enjoy the sudden and sharp rebound in 1983 felt in some of the other major grades. Production of newsprint—the primary end use for recycled newspapers—was on the upswing late in 1983. The market also seemed to be tightening due to improvement in the housing industry, but the market for insulation continued to be dominated by alternative insulation materials such as fiberglass and foam. An estimated 300,000 tpy of old news is used to make cellulose insulation.

In 1983, the high grades of paper stock showed the most dramatic increase of all recycled fiber in volume of shipments, according to NARI. Demand from both domestic buyers and overseas buyers was exceptionally strong. For the first eight months of 1983, uncoated free-sheet shipments were up 10% over the same period in 1982. Unfilled orders for uncoated free-sheet papers were up more than 85% over comparative 1982 levels and nearly 68% over those levels in the first eight months of 1981.

Deinking grades showed the largest rise in movement during the first eight months of 1983 compared with a year earlier, according to NARI. They increased nearly 18% over 1982 levels and almost 23% over 1981 levels. Pulp substitutes also showed an increase in shipments of just 3% over 1982 and declined 6% from 1981.

The pulp substitutes, the cleanest and most expensive

U.S. WASTEPAPER DOMESTIC UTILIZATION AND EXPORTS

(000 short tons)

	Used	Exported	Total	Exports as percent of total
1984p	15,847	3,248	19,095	17%
1983	14,539	2,574	17,113	15
1982	13,565	2,127	15,692	14
1981	15,037	2,213	17,659	13
1980	14,922	2,664	17,972	15
1979	15,361	2,233	17,594	13
1978	14,760	1,599	16,359	10
1977	14,058	1,512	15,570	10
1976	13,622	1,273	14,895	9
1975	11,748	861	12,843	7
1974	13,982	1,307	15,289	9
1973	14,094	683	14,777	5
1972	12,925	415	13,340	3
1971	12,106	419	12,525	3
1970	11,803	408	12,211	3

e — Estimate

Source: American Paper Institute.

of the wastepaper grades, were bolstered by the drawdown in virgin pulp inventories and increasing woodpulp prices late in 1983. The market got even stronger in the first quarter of 1984 due to a ten-week lockout of mills in British Columbia and a subsequent rise in pulp prices.

The high grades command the highest prices of all wastepaper grades and tend to retain a relatively good market even when demand for the lower grades is severely curtailed and prices plummet. This is because the high grades are used in the manufacture of less volatile grades of paper like tissue and printing and writing papers.

Wastepaper prices in general, however, are quite sensitive to the supply/demand situation and tend to rely heavily on local markets. Typically low prices for most grades, combined with their bulk, make it unfeasible to haul them great distances except during shortages, when prices skyrocket.

Markets are also affected by the export picture. When export markets are good, wastepaper prices are good throughout the country, even though the major wastepaper export markets are off the East and West Coasts and Gulf of Mexico. This is due to a rippling effect which tightens the market in other regions as well, although prices usually vary.

When export demand is low it causes a glut that reverberates throughout the market. In 1981, the curtailed export market, combined with relatively flat U.S. domestic demand, caused a glut that sent prices in a tailspin for all grades, although the low grades like mixed, news and old corrugated were more severely affected than the high grades.

In 1983, however, the situation turned around and prices more than doubled in some cases, with the low grades experiencing the most sudden and sharp rises as both domestic and overseas mills competed for supplies, attempting to rebuild inventories in anticipation of better business.

EXPORTS/IMPORTS

The U.S. remains by far the greatest exporter of wastepaper. Wastepaper exports have been growing at a rapid pace over the past decade, rising from only 408,000 tons in 1970. A significant decline occurred in 1981, however. In that year, wastepaper exports dropped by 17% to 2.21 million tons from 2.64 million tons in 1980—a record year—because of weak economies worldwide. In 1983, however, exports were at a three-year high of 2.62 million tons, a 23.1% increase over 1982 but still 1.7% lower than in 1980, according to NARI.

Just seven countries together buy most of the wastepaper exported from the U.S.: South Korea, Canada, Mexico, Taiwan, Japan, Italy and Venezuela. In 1983,

U.S. WASTEPAPER EXPORTS, 1970-83

(short tons)

	News	Corrugated	High-grade de-inking	High-grade pulp substitutes	Other	Total
1983	461,153	993,436	224,701	189,578	750,463	2,393,381
1982	444,093	886,655	140,349	163,790	492,131	2,127,018
1981	425,060	991,115	130,319	192,192	473,863	2,212,549
1980	424,864	1,208,609	176,442	204,881	649,395	2,664,191
1979	336,138	960,369	134,959	153,950	647,686	2,233,102
1978	366,005	576,653	93,307	92,452	471,032	1,599,449
1977	644,038	591,529	301,273[1]	—	341,526	1,878,366[2]
1976	244,118	426,104	300,096[1]	—	302,418	1,272,626
1975	164,294	333,631	176,145[1]	—	187,318	861,388
1974[3]	—	—	—	—	—	1,307,000
1973[3]	—	—	—	—	—	683,444
1972[3]	—	—	—	—	—	415,033
1971[3]	—	—	—	—	—	419,046
1970[3]	—	—	—	—	—	408,000

1. Includes "high-grade pulp substitutes."
2. Subsequent revision by Census changed total to 1,544,000 tons, due to errors reported in exports to Greece and Canada; revision does not indicate which wastepaper grades are affected by the change.
3. No grade designations prior to 1975.

Source: Bureau of the Census.

consumption in some of these countries was up markedly from 1982 levels.

Mexico bought 473,000 tons in 1983 compared with 236,300 tons in 1982. South Korea's consumption was up to 557,200 in 1983 compared with 512,000 tons in 1982. Canadian imports of U.S. wastepaper increased to 346,800 tons in 1983 from 271,400 tons in 1982. Taiwan bought 544,900 tons in 1983 compared with 462,100 tons in the prior year. And Japan imported 266,000 tons in 1983 after taking just 105,800 tons in 1982.

DRI expects wastepaper exports from the U.S. to rise 75% over 1980's peak in the next decade. By 1993 exports are expected to represent 18% of the 26 million tons of total demand for U.S. wastepaper.

Taiwan and Korea are expected to continue to be the major export markets for U.S. wastepaper during the next decade, according to DRI. During that time, their consumption will go up 150% and by 1993, will account for 50% of the U.S. wastepaper export market. Exports to Canada and Mexico will be up approximately 70 to 75% in the period 1982-93 but will never reach the peaks of 1979 and 1980, DRI reports.

The U.S. imports less than 1% of its wastepaper for use in paper and paperboard mills. The import market has averaged 78,500 tpy during 1976-81. Most of the wastepaper—about 98%—is supplied by Canada.

DRI, in a 1983 study, projects U.S. wastepaper imports will reach 100,000 tons by 1993, a still relatively insignificant amount. API statistics indicated the U.S. imported 100,410 tons of paper stock in 1983, up from 74,332 in 1982. Preliminary figures indicate U.S. consumption of imported wastepaper should decline slightly this year to around 95,000 tons.

CANADA'S TRADE AND USE

Canada's tight partnership with the U.S. in the wastepaper market has deteriorated slightly in the past few years. Although Canada remains one of the highest consumers of U.S. wastepaper exports, since 1980 it has dropped into fourth place from second place in its ranking among top export markets for U.S. wastepaper. Now it trails South Korea (highest consumer of U.S. wastepaper exports in 1983), Taiwan and Mexico.

The potential of the Canadian market as a major U.S. wastepaper consumer may be stunted in the future by a lack of growth in the ratio of wastepaper used in the overall production of paper and paperboard in Canada. Canada's consumption of wastepaper has been relatively low, just 1.276 million metric tons in 1981.

During the past two years, Canadian consumption of U.S. wastepaper rose to 346,809 tons in 1983 from 271,395 tons in 1982. In the early part of 1984, however, Canada's usage was off slightly and the annualized trend indicated Canada would buy less than 300,000 tons of U.S. secondary fiber in 1984.

In the past, the U.S. has remained a viable market for Canadian wastepaper. In 1983, the U.S. imported 94,365 tons of wastepaper from Canada, according to API. Of this, 61,697 tons were mixed news; 13,324 tons were old corrugated; 17,887 tons, old news; 5,595 tons, pulp substitutes; and just 862 tons, hi-grade deinking.

PULPING

Pulping wastepaper is considerably simpler than pulping wood. Primarily, the process involves separating the web or sheet into individual fibers. Removal of any ink is considered a separate process and is called deinking.

A pulper is generally used in pulping secondary fiber. It is filled with water, and wastepaper is added usually from a conveyor belt until a consistency of at least 5% to 6% wastepaper is reached. A spinning rotor in the bottom of the pulper tears the paper into smaller pieces. These pieces, in turn, rub against each other to further break down the fibers. Stock removed from the pulper normally passes through a screen to remove pieces that

WASTEPAPER IMPORTS INTO U.S. BY GRADE

(short tons)

	1983	1982
Mixed papers	62,117	44,706
Printed news	17,964	12,206
Old corrugated	13,825	10,839
Pulp substitutes	5,609	5,845
High-grade deinking	895	585
TOTAL	100,410	74,332

Source: Bureau of the Census data

WASTEPAPER IMPORTS INTO U.S.

(short tons)

1983	100,410
1982	74,332
1981	78,064
1980	87,104
1979	78,395
1978	80,719
1977	81,013
1976	106,444
1975	71,983
1974	88,527
1973	88,804
1972	88,167
1971	88,244
1970	88,837

Source: Bureau of the Census data

WASTEPAPER PRICES BY REGION, FOR SELECTED GRADES, 1994

($/short ton, f.o.b. sellers dock)

	New York	Chicago	Atlanta	SF-LA
NO. 1 NEWS				
June	45	55	45-50	60-70
May	45	55-60	45-50	60-70
April	50-60	55-60	45-50	60-75
March	50-60	55-60	45-50	60-75
February	50-60	55-60	45-50	60-75
January	45-50	50-55	45-50	50-60
OLD CORRUGATED CONTAINERS				
June	50	60	60-65	75
May	45-50	60	60-65	85-90
April	50	60	60-65	85-90
March	50	60	60-65	85-90
February	50	60	60-65	80-90
January	45-50	60	60	75-85
NEW DOUBLE LINED KRAFT CORRUGATED CLIPPINGS				
June	77.50-82.50	77.50-82.50	80	105
May	75-80	80	80	110
April	75-80	80-85	80	110
March	75-80	80-85	80	110
February	70-75	80-85	80	110
January	70	75-80	80	90-110
PULP SUBSTITUTES, Hard white shavings				
June	240-250	240-250	230-250	240-250
May	235-240	240-250	230-240	240-250
April	235-240	230-240	230	240-250
March	235-240	220-230	230	230-240
February	235-240	220-230	230	230
January	210-215	210-220	210	195
HIGH-GRADE DEINKING, White ledger				
June	145-150	120-130	135-140	140-155
May	145-155	120-130	130	135-150
April	135-145	120-130	130	135-150
March	130-135	120-130	130	125-140
February	130-135	120-130	130	125-135
January	130-135	120-130	94-130	120
HIGH-GRADE DEINKING, Colored ledger				
June	115-120	115-120	115-120	115-130
May	115-120	100-110	100-110	110-125
April	115-120	100-110	100-110	110-125
March	115-120	100-110	100-110	100-115
February	105-120	100-110	100-110	100-110
January	105-120	100-110	80-110	85
HIGH-GRADE DEINKING, Coated book stock				
June	50	45-50	45-50	50
May	45-50	45-50	45-50	50
April	45-50	45-50	45-50	45
March	45-50	45-50	45-50	40
February	45-50	45-50	45-50	40
January	45-50	45-50	45-50	40

Source: PULP & PAPER WEEK.

have not been sufficiently broken down.

Chemically treated or coated wastepaper, which may be more difficult to repulp, requires further processing. Usually the water in the pulper is heated to 67° C (150° F), and chemicals such as sodium hydroxide or soaps and dispersing agents, or all of these, are added.

In the deinking operation, washing equipment and special chemicals lift or remove ink from the paper. Some wastepaper, however, is difficult and even sometimes impossible to deink economically because of plastics or pressure-sensitive adhesives in the paper. The cost of deinking can approach the cost of buying virgin fiber in a weak fiber market, thus pricing it out of the market.

GOVERNMENT TARGETS

Local, state and federal governments have become increasingly more involved in recycling in the past decade, even passing laws to promote recycling programs.

Probably the most significant impact of this trend on the wastepaper market came in May 1980 when the U.S. Dept. of Energy established 1987 goals for use of secondary fiber in the manufacture of six major grades of paper and paperboard. These are shown in the table.

The amount of wastepaper furnish used in the production of unbleached kraft paperboard will show the largest increase in 1987 (from 8% to 18%), according to Dept. of Energy projections. Printing/writing and building board grades will use less paper stock (from 7% to 6% and 22% to 17%, respectively).

Municipal intervention in recycling, however, could prove damaging to the wastepaper market. Officials in cities that have built plants to use wastepaper as an energy source have increasingly been putting pressure on local residents to channel all their waste to these waste-to-energy plants or resource recovery plants. The federal government allows these municipalities to enact flow ordinances which make it illegal to sell wastepaper to paper stock dealers.

U.S. WASTEPAPER PRICE INDEXES

(100 = 1967)

	No. 1 news	No. 1 mixed	Old corrugated boxes	Semi-chemical kraft clippings	Mixed kraft clippings	White news blanks
1984	[illegible]	[illegible]	[illegible]	[illegible]	n.a.	[illegible]
1983	[illegible]	[illegible]	[illegible]	[illegible]	n.a.	[illegible]
1982[3]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1981	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1980	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1979	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1978	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1977	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1976	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1975	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1973	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1972	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1971	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1970[4]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

n.a. = Not available.
1) Average of 6 months.
2) Average of 9 months.
3) Data through September 1980 due to BLS collection problems.
4) [illegible]

Source: Bureau of Labor Statistics.

CONVERTED PAPER AND BOARD PRODUCTS

[illegible]

[illegible]

CORRUGATED CONTAINERS

[illegible]

PACKAGING SALES BY PACKAGING MATERIALS FOR [illegible]

	[illegible]	[illegible]
Total packaging sales	[illegible]	[illegible]
Paper and paperboard	[illegible]	[illegible]
Corrugated containers	[illegible]	[illegible]
Folding cartons	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Sanitary food containers	[illegible]	[illegible]
Others	[illegible]	[illegible]
Metal	[illegible]	[illegible]
Cans	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Other materials	[illegible]	[illegible]
Glass	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Others	[illegible]	[illegible]

[illegible]

[illegible]

U.S. CONVERTED PRODUCTS INDUSTRY VALUE OF SHIPMENTS

[illegible]

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total converted paper products	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total boxes and containers	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

plants and cut and print these into container blanks.

In 1983, the number of plants in U.S. was 1,370, of which 614 were classified as converting plants and 756 as sheet plants, according to the Fibre Box Assn. This was down from a peak of 1,460 plants in 1979, of which 649 were converters and 811 were sheet plants. The number of sheet plants has grown relative to the total because of the lower capital costs and technology required to build them. Nevertheless, sheet plants in 1983 accounted for only about 12.2% of total corrugated box shipments compared with 11.7% in 1970.

The number of converting plants has been declining because of improved technology, which has increased the shipment volume per plant. The average converting plant in 1983 shipped 361 million ft^2 of corrugated containers compared with an average of 262 million ft^2 in 1970.

The corrugated container industry is highly integrated with paperboard manufacturing. Integrated companies account for about 75% to 80% of total U.S.

U.S. PRICE INDEXES FOR MAJOR CLASSES OF CONVERTED PRODUCTS

(1967 = 100)

	All converted products	Sanitary paper & health products	Paper Bags & shipping sacks	Boxes & shipping container	Composite cans
1983	265.3	361.2	260.6	248.4	317.7
1982	264.4	353.7	263.4	249.6	298.5
1981	258.9	347.4	n.a.	243.8	272.8
1980	238.4	325.1	246.4	223.2	253.3
1979	209.9	279.9	220.4	197.6	226.4
1978	186.5	253.8	190.9	174.6	209.6
1977	176.6	236.5	171.5	167.6	194.3
1976	170.0	214.4	163.5	164.7	179.0
1975	161.8	197.4	155.8	158.0	167.4
1974	144.9	155.7	138.7	146.0	143.6
1973	121.6	124.9	119.2	124.5	122.3
1972	113.6	121.0	107.6	115.9	115.9
1971	109.7	119.5	100.2	112.3	112.3
1970	107.8	115.1	106.8	108.3	108.3

n.a. = Not available.

Source: Bureau of Labor Statistics.

U.S. CORRUGATED BOX SHIPMENTS BY REGION

(Billion ft^2/yr)

Year	Total	Northeast	Southeast	East Central	North Central	Southwest	West
1983	252.5	50.3	44.1	37.2	31.3	47.4	42.2
1982	235.2	48.0	39.7	34.3	28.8	44.4	40.0
1981	246.2	50.1	41.7	37.6	30.0	45.2	41.6
1980	241.4	50.6	41.3	36.9	30.1	42.9	39.6
1979	250.6	53.3	41.6	41.1	31.8	43.2	39.7
1978	243.9	52.3	38.8	41.4	31.4	41.8	38.3
1977	227.2	48.3	35.2	39.8	29.6	38.6	35.6
1976	216.4	46.8	32.8	38.3	28.5	36.2	33.8
Annual rate of growth	3.5%	1.1%	4.3%	−.4%	1.3%	3.9%	3.2%

Source: Fibre Box Assn.

U.S. CORRUGATED PRODUCTION AND INVENTORY

	Production[1] (billion square feet)			Inventory[3] Containerboard	
	Single wall	Double & triple wall	Total[2]	Tonnage (000 sh tons)	Weeks of supply
1984	—	—	—	2,437	7.2
1983	240.3	22.7	264.2	2,584	8.9
1982	224.2	20.9	246.3	2,729	9.4
1981	229.8	22.1	253.0	1,984	6.2
1980	229.1	21.7	251.9	1,979	6.2
1979	236.7	23.2	261.1	1,961	5.8
1978	232.8	22.3	256.4	2,436	7.2
1977	217.2	20.4	238.8	2,527	8.1
1976	207.9	18.6	227.8	2,185	7.2
1975	186.2	15.9	203.2	2,323	8.2
1974	203.4	19.1	224.1	1,595	4.7
1973	216.8	20.2	238.5	1,603	5.1
1972	200.9	17.6	220.1	1,639	5.7
1971	183.8	15.1	200.3	1,879	7.0
1970	177.1	14.1	192.7	1,760	6.5

1. Production includes waste and trim before fabrication.
2. Total includes single-face production which has averaged around 1.3 billion square feet per year.
3. Inventory of linerboard, corrugating medium, and filler board at box plants and paperboard mills based on inventory at January 1 of each year.

Source: Fibre Box Assn.

SUMMARY OF STATISTICS FOR CORRUGATED AND SOLID-FIBER BOX INDUSTRY

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1982	1,481	93,800	$10,515.0	$279.5
1981	—	97,300	10,760.0	271.2
1980	—	97,200	9,650.5	420.5
1979	—	103,700	8,975.9	303.0
1978	—	105.800	8.030.3	282.5
1977	1,472	101,500	7,351.1	243.3
1976	—	101,400	6,681.8	185.1
1975	—	94,700	5,820.6	207.9
1974	—	106,800	6,014.6	200.9
1973	—	109,700	5,229.6	125.0
1972	1,265	107,900	4,308.8	101.5
1971	—	102,700	3,667.7	87.5
1970	—	104,700	3,545.0	108.9
1969	—	105,600	3,500.1	161.9
1968	—	100,700	3,230.5	135.6
1967	568	97,100	2,959.6	127.7

Paperboard consumed (estimated):

1982: 18,306,800 short tons
1977: 17,272,100 short tons

Source: Bureau of the Census.

corrugated box shipments. Most sheet plants are owned by nonintegrated companies.

Unlike paperboard mills, corrugated container plants operate one to two shifts a day and generally on a 5- to 6-day week. The production units vary in size (with an average of 67 employees per plant) and are located close to their markets, principally near large industrial and urban centers.

As noted earlier, lagging container prices have put the industry under severe cost pressure. This has forced container plants to improve productivity and results have been dramatic. Shipments per week per employee have risen from 46,600 ft^2 in 1970 to 79,900 ft^2 by 1983—an increase of 71%. The total number of employees in the industry has declined over this period from 74,100 in 1970 to 59,600 by 1983. The dramatic improvement in productivity has helped slow the industry's rise in unit labor costs. While total hourly payroll costs spiraled up 188% in this period, unit labor costs increased 58%, according to Fibre Box Assn. data.

New technology has included the adoption of flexographic printing and the rotary die cutter in the 1960s, followed by the appearance of the continuous corrugator in the mid-1970s. New state-of-the-art continuous corrugators today can run at 800 to 1,000 fpm compared with about 600 fpm for a typical corrugator in the early 1970s.

Such high-speed machines make moisture uniformity, mechanical roll quality and bonding speed of liners to medium increasingly important. Moisture variation in containerboard can cause warp which high-speed corrugators cannot tolerate, while roll defects may lead to costly downtime from web breaks, according to James F. Stevenson of SAS International Inc. More U.S. containerboard manufacturers are showing an interest in meeting such uniform moisture requirements.

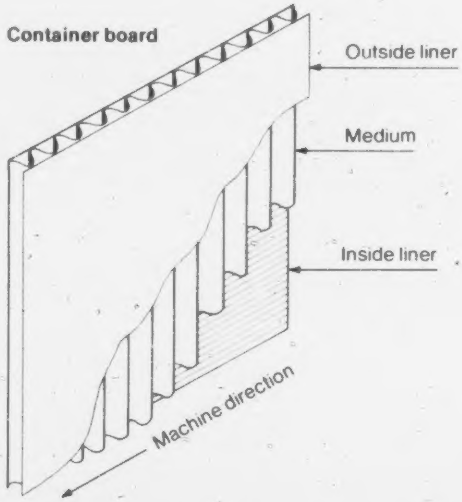
Changing market requirements. The trend to stacking containers to ever greater heights on pallets in

COMMON FLUTES USED IN PRODUCTION OF CORRUGATED CONTAINERBOARD

	Number of flutes[1] per		Flute height[2]	
Flute	Lineal foot	Lineal meter	inch	mm
A	36	118	3/16	4.76
B	51	168	3/32	2.38
C	39-42	128-138	9/64	3.57
E	96	316	3/64	1.19

[1] Approximate

[2] Exclusive of liners



Source: *Metrication for the Pulp and Paper Industry*, Miller Freeman Publications warehouses and in delivery has been increasing the demand for containers with greater top-to-bottom compression strength. This trend is being reinforced by a shift from rigid metal and glass containers to plastic flexible packaging in primary containers. At the same time, palletization has eliminated much of the manual handling of individual corrugated cases in the transportation system. This has reduced the mullen and bursting strength requirements for corrugated board.

Another trend has been toward increased emphasis on the graphic quality of corrugated containers. The corrugated box is increasingly serving not only as a shipping container, but also as point-of-purchase display in self-service mass merchandise stores. This has led to growing interest in flexographic preprinting of linerboard. About one dozen flexographic preprint facilities will be operating in the U.S. by the end of 1985 with a combined annual preprint capacity of about nine billion ft—or about 3.5% of total corrugated box shipments, according to an estimate by Robert Draper, of Pioneer Container Corp.

The growing emphasis on compression strength, combined with the need for containerboard made from less expensive fiber, is behind an industry move for an alternate to Rule 41. Rule 41 and Item 222 govern corrugated box specifications for shipment by rail and truck and are used to determine liability if freight is damaged in transit. Such an alternate rule has been approved for field testing by both the railroad and truck classification committees.

According to Fibre Box Assn., the alternate rule differs from the current rule in that it emphasizes compression strength of corrugated board as measured by its edge crush value. The edge crush values in the alternate rule are slightly higher than those being obtained on most corrugated boxes currently being used in the U.S. Basis weights of facings have not been changed from the current levels, but bursting strength requirements for most grades are reduced about 20%. This will permit containerboard manufacturers to expand their fiber base by using more hardwood, and to change their operations to produce linerboard and medium with better stiffness.

Many proponents of the alternate rule would eventually like to see basis weight requirements for linerboard and medium eliminated. According to Stevenson, it is common in the U.S. to use 121 lb of fiber/1,000 ft^2 for applications successfully packaged and shipped in Europe with 94 lb/1,000 ft^2—resulting in "a very significant waste of fiber and excess cost in the U.S."

Future outlook. Corrugated container shipments will probably continue to track industrial production through the 1980s, indicating an average annual growth rate of about 3%.

Competition from other packaging systems is not serious but alternate packaging materials are having and will continue to have a negative impact on some container sectors. For example, shrinkcase packaging for canned goods is forecast to displace some container production.

Shrinkcase packaging uses a base made from corrugated containerboard overwrapped with a seethrough

SUMMARY OF SHIPMENTS IN 1983 OF CORRUGATED CONTAINERS BY END-USE INDUSTRY

	Percent of total sq. footage
1. Food and similar products	38.1%
2. Paper and allied products	12.9
3. Stone, clay, glass products	7.1
4. Chemical and allied products	6.7
5. Rubbert & misc. plastic products	6.1
6. Electrical machinery	4.5
7. Misc. manufacturing products	4.0
8. Fabricated metal products	3.3
9. Furniture and fixtures	3.1
10. Textile mill products	2.4
11. Machinery, except electrical	1.9
12. Apparel and fabrics	1.7
13. Printing, publishing & allied industries	1.7
14. Transportation equipment	1.5
15. Lumber and wood products	1.0

Source: Fibre Box Assn. 1983 annual report.

U.S. CORRUGATED BOX PRICE TRENDS

	BLS Corrugated shipping containers for food and beverages[1]	FBA National overall corrugated box price trend[2]	
	(1967 = 100)	(1967 = 100)	(\$1,000 ft^2)
1983	243.2	219.5	\$36.85e
1982	243.9	225.9	37.92e
1981	244.6	230.0	38.61e
1980	230.7	212.8	35.73e
1979	205.2	188.9	31.71
1978	180.3	168.1	28.23
1977	173.6	168.2	28.24
1976	173.1	169.6	28.48
1975	165.6	165.5	25.79
1974	152.6	152.2	25.91
1973	131.9	122.5	20.56
1972	188.6	107.4	18.03
1971	112.1	104.2	17.49
1970	108.4	104.8	17.59

e = Estimate.

Source: 1. Bureau of Labor Statistics. 2. Fibre Box Assn.

CORRUGATED AND SOLID FIBER BOX SPECIFICATIONS FOR RAILROAD (RULE 41)

		Corrugated fiberboard						Solid fiberboard	
		Single wall		Double wall		Triple wall			
Maximum weight of box and contents lb	Maximum inside dimensions (length, width and depth added) in.	Minimum inside combined weight of facings lb/1,000 ft²	Minimum bursting test of combined board psi	Minimum combined weight of facings including center facing lb/1,000 ft²	Minimum bursting test of combined board psi	Minimum combined weight of facings including center facing lb/1,000 ft²	Minimum puncture test of combined board in.-oz./in.-tear	Minimum combined weight of component plies (exclusive of adhesives) lb/1,000 ft²	Minimum bursting test of combined board psi
20	40	52	125	—	—	—	—	114	125
30	50	66	150	—	—	—	—	—	—
40	60	75	175	—	—	—	—	149	175
65	75	75	200	92	200	—	—	190	200
90	90	138	275	110	275	—	—	237	275
120	100	180	350	126	350	—	—	283	350
140	110	—	—	222	500	—	—	330	500
160	120	—	—	270	600	—	—	360	600
275	120	—	—	—	—	264	1,100	—	—

RULE 41 ALTERNATE CONSTRUCTION

		Single wall			Double wall		
Maximum weight of box and contents lb.	Maximum inside dimensions (length, width and depth added) in.	Minimum combined weight of facings lb/1,000 ft²	Minimum bursting test of combined board psi	Minimum edgewise compressive strength lb/in.²	Minimum combined weight of facings lb/1,000 ft²	Minimum bursting test of combined board psi	Minimum edgewise compressive strength lb/in.²
20	40	52	100	23			
35	50	66	120	26			
50	60	75	140	29			
65	75	84	160	32			
80	85	111	190	38	92	160	45
95	90	138	220	45	110	200	40
120	100	180	280	60	126	250	55
140	105				180	320	70
160	110				222	400	82
180	120				270	480	96

Source: Fibre Box Assn.

polyethylene shrinkfilm. This packaging system is expected to continue to grow at the expense of all-corrugated containers, especially for unitizing shipments of canned, bagged and boxed food products.

Other packaging systems, notably foams based on urethane and polystyrene, have limited applications and do not offer the broad-based versatility of corrugated containers.

FOLDING PAPERBOARD BOXES

This paperboard possesses strength qualities that permit scoring and folding, with variable surface properties depending upon the printing requirements. It is suitable for the manufacture of folding cartons, and can be made from a large variety of raw materials on either a cylinder machine or a fourdrinier machine. According to industry statistics, recycled clay-coated board garnered a 39.2% share of this market in 1983, while solid bleached sulfate paperboard held 34.7%.

Domestic folding carton shipments generally follow consumer spending and real disposable income levels. During the economic recession of 1981-82, folding carton end-use markets—particularly for such discretionary uses as packaged commodities which the consumer is able to do without—experienced some decline, subsequently affecting folding carton demand, according to the Bureau of Industrial Economics.

Following three consecutive years of decline, the real value of shipments of folding cartons rose 1.5% in 1983

FOLDING PAPERBOARD BOXES (SIC CODE 2651)

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1982	564	43,700	$3,922	$102.2
1981	—	44,300	3,557	100.9
1980	—	45,500	3,276	92.2
1979	—	45,000	2,950	76.8
1978	—	45,600	2,884	100.3
1977	574	44,700	2,579	89.8
1976	—	40,600	2,233	65.2
1975	—	38,300	1,952	67.0
1974	—	43,200	1,890	60.0
1973	—	45,300	1,644	41.8
1972	544	45,300	1,487	37.4
1971	—	44,900	1,366	33.7
1970	—	48,700	1,387	49.9

Paper consumed (estimated):
1982: 3,124,000 short tons (of which 1,744,800 purchased on the open market)
1982: 3,143,000 short tons (of which 1,764,000 purchased on the open market)

Source: Bureau of the Census.

FOLDING PAPERBOARD BOX SHIPMENTS BY END-USE

(millions of $)

	1982	Percent of total	1977	Percent of total
Dry food and produce (including pet food)	$539.3	14.3%	$367.5	15.4%
Bottled and canned beverages (including carriers)	483.2	12.8	267.3	11.2
Soaps & detergents	165.4	4.4	147.0	6.1
Tobacco	190.2	5.1	83.7	3.5
Hardware, household supplied	283.6	7.6	213.6	8.9
Candy	101.4	2.7	73.1	3.1
Cosmetics and medicine	473.8	12.6	264.7	11.0
Paper goods (including book mailers)	305.5	8.2	264.0	11.0
Retail food carryout boxes and trays	296.9	7.9	n.a.	n.a.
All other uses	604.5	16.1	516.9*	21.5
Miscellaneous	303.4	8.1	195.6	8.2
Total	3,747.4		2,393.4	

*Includes retail food boxes.

Source: Bureau of the Census.

to $3.98 billion. This was attributed to the increased strength of consumer nondurables, which were not as severely affected as the industrial sector by the economic downturn.

Changes in product mix and use of less dense folding carton board in the manufacturing process were partially responsible for minimal growth in folding carton tonnage (less than 1% compounded annually) between 1972 and 1983.

The industry has also been affected by long-term slow growth in the packaged food sector, its major end-use market, although this sector has traditionally been least affected by economic downturns, according to BIE. The bureau estimates that food and beverage markets accounted for about 55% of the folding carton industry's annual sales in 1982-83, compared with 50% in 1972.

In recent years, there has been a trend to use less SBS and more clay-coated recycled board, according to BIE (see related chapters on recycled board and bleached board). Some industry observers, however, are skeptical that this trend will continue.

The folding carton industry is expected to grow at the rate of 1.2% compounded annually to a level of about 2.95 million tons of carton shipments by 1988, according to BIE. During the next few years, competition from plastics and other types of paperboard containers will gradually increase, though folding carton is expected to retain its leadership market position in the nondurables packaging market.

U.S. SETUP PAPERBOARD BOXES SUMMARY OF INDUSTRIAL STATISTICS

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1982	261	10,300	413	9.3
1981	—	13,700	511	18.6
1980	—	13,500	465	16.2
1979	—	13,400	434	14.6
1978	—	13,700	409	n.a.
1977	312	13,100	361	8.8
1976	—	15,500	402	4.6
1975	—	14,500	350	15.1
1974	—	18,300	387	5.6
1973	—	16,000	320	5.7
1972	395	18,100	321	6.4
1971	—	19,700	332	8.5
1970	—	22,000	326	12.0

Paperboard consumed (estimated):

1982: 196,400 short tons (188,000 from open market)
1977: n.a.

n.a. = Not available.

Source: Bureau of the Census.

END-USES FOR RIGID PAPERBOXES

(Percentage distribution)

	1981	1980	1978	1976	1974	1970
Textile, apparel, hosiery	5.5%	4.4%	7.3%	3.7%	4.9%	18.9%
Department stores and specialty shops	7.1	6.8	10.1	10.7	10.1	13.1
Cosmetics and soaps	3.9	5.5	3.3	5.3	3.9	6.2
Confections	18.0	12.6	9.0	10.5	9.8	7.9
Stationery and office supplies	9.3	13.5	11.8	12.5	10.4	8.2
Jewelry and silverware	9.7	9.3	10.7	4.2	8.6	3.2
Photographic	4.3	4.5	3.0	2.4	3.2	2.6
Shoe and leather	0.2	0.3	3.7	1.3	7.5	4.4
Drugs, chemical, pharmaceuticals	7.8	7.5	4.9	9.3	7.8	4.2
Toys and games	1.8	1.4	2.1	3.3	1.1	7.0
Hardware & household supplies	4.0	5.5	5.4	6.4	7.7	4.9
Food, beverages	3.9	4.3	2.9	3.6	1.2	0.8
Sporting goods	1.2	1.2	1.2	0.7	1.4	2.6
Other major customers						
Electronics	3.5	3.6	2.9	4.2	2.3	—[1]
Educational	4.4	3.7	5.2	3.9	4.8	—[1]
Other and miscellaneous customers	15.4	15.9	16.5	18.0	15.3	9.6

1. Listed under other and miscellaneous customers.

Source: National Paperbox & Packaging Assn.

U.S. INDUSTRY SUMMARY OF FIBER CANS, DRUMS AND SIMILAR PRODUCTS

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1982	304	13,900	$1,475.9	$29.4
1981	—	16,200	1,496.0	37.3
1980	—	15,900	1369.6	42.9
1979	—	17,100	1296.6	31.2
1978	—	16,300	1118.8	23.6
1977	309	16,100	1011.1	26.7
1976	—	16,600	935.5	26.6
1975	—	16,900	837.3	27.5
1974	—	19,600	828.4	30.5
1973	—	18,200	673.2	16.8
1972	282	17,300	568.0	17.9
1971	—	16,200	495.2	16.4
1970	—	16,500	464.6	16.1
1969	—	16,400	445.1	16.8

Source: Bureau of the Census.

U.S. PRODUCTION OF UNBLEACHED KRAFT AND RECYCLED PAPERBOARD FOR TUBE, CAN AND DRUM STOCKS

(000 short tons)[1]

Year	Kraft	Recycled
1983	99	841
1982	151	767
1981	334	808
1980	220	564
1979	232	628
1978	202	602
1977	180	680
1976	172	702
1975	145	631
1974	213	733
1973	215	763
1972	216	728
1971	159	642
1970	194	573
1969	180	527

[1] Some bleached kraft paperboard is also produced for these uses, but is not included in these data.

Source: Bureau of the Census.

FIBER CANS, DRUMS AND SIMILAR PRODUCTS: SHIPMENTS AND TONNAGE BY TYPE

	1982	1977	1972
Fiber drums			
Product shipments, $ million	289.8	223.8	136.9
Paper & board consumed, 000 tons	137.4	149.4	160.1
Fiber and composite cans			
Product shipments, $ million	701.1	469.0	253.2
Paper & board consumed, 000 tons	212.5	210.9	216.1
Cores and tubes			
Product shipments, $ million	340.9	263.4	164.3
Paper & board consumed, 000 tons	746.6	638.7	624.5
Paperboard cores, reels[1]			
Product shipments, $ million	46.5	36.7	31.0
Paper & board consumed, 000 tons	41.0	63.5	79.1
Vulcanized fiber products[2]			
Product shipments, $ milion	n.a.	6.6	14.0
Paper & board consumed, 000 tons	25.4	n.a.	34.3
Other, not specified			
Product shipments, $ million	105.8	40.8	20.0

[1] Includes spools, bobbins, and blocks.
[2] Includes boxes, cans, tubes, drums.

Source: Bureau of the Census.

STATISTICAL SUMMARIES (BASED ON DATA FROM CENSUS BUREAU)

ENVELOPES (SIC Code 2642)

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1982	299	25,100	$1,799	$46.2
1981	—	25,600	1,601	38.1
1980	—	25,600	1,460	55.2
1979	—	24,900	1,304	38.7
1978	—	22,900	1,121	29.3
1977	265	22,600	991	22.9
1976	—	21,700	870	22.7
1975	—	21,900	830	19.1
1974	—	24,300	868	19.2
1973	—	23,300	690	21.1
1972	247	22,900	621	17.4
1971	—	22,400	573	23.1
1970	—	23,400	574	21.6

Paper consumed (estimated):[1]

1982: 845,000 short tons (797,000 purchased in open market)
1977: 677,000 short tons
1972: 695,000 short tons
Number envelopes produced:
1982: n.a.
1977: 97,889 million
1972: 96,599 million

[1] An estimated 13,000 tons of paperboard included for 1977 and 29,000 for 1972.

DIE-CUT PAPER AND BOARD (SIC Code 2645)

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1982	396	15,700	$1,676	$32.7
1981	—	17,200	1,677	23.2
1980	—	16,600	1,454	41.0
1979	—	17,000	1,468	32.7
1978	—	15,100	1,189	26.4
1977	371	14,300	1,058	15.3
1976	—	15,300	1,027	28.6
1975	—	14,800	943	17.1
1974	—	16,500	923	23.3
1973	—	15,900	747	12.9
1972	374	15,200	676	10.6
1971	—	17,300	612	17.8
1970	—	18,200	612	17.8

Paper and paperboard consumed (estimated):

Paper
1982: 353,000 short tons
1977: 259,000 short tons
1972: 510,000 short tons
Paperboard
1982: 982,100 short tons
1977: 927,000 short tons
1972: 953,000 short tons

MISCELLANEOUS CONVERTED PRODUCTS (SIC Code 2649)

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1982	776	27,200	$2,384	$68.9
1981	—	30,100	2,598	55.4
1980	—	30,800	2,329	66.3
1979	—	30,100	2,043	86.3
1978	—	30,100	1,901	77.6
1977	833	29,400	1,698	51.1
1976	—	22,800	1,288	25.4
1975	—	21,700	1,090	29.6
1974	—	24,000	1,079	37.7
1973	—	22,000	833	25.4
1972	307	18,100	631	18.5

Paper and paperboard consumed (estimated):

Paper
1982: 514,300 short tons
1977: 424,000 short tons
1972: 495,000 short tons
Paperboard
1982: n.a.
1977: 169,000 short tons
1972: 112,000 short tons

STATIONERY PRODUCTS (SIC Code 2648)

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1982	216	12,700	$1,035	$21.5
1981	—	11,900	892	13.1
1980	—	13,000	836	12.7
1979	—	13,400	766	14.6
1978	—	13,900	747	18.4
1977	242	12,600	652	15.9
1976	—	12,300	653	12.7
1975	—	12,100	591	15.5
1974	—	13,300	605	8.0
1973	—	15,000	493	6.5
1972	431	14,700	450	9.3

Paper consumed (estimated):

1982: 422,000 short tons (337,000 purchased on open market)
1977: 470,000 short tons
1972: 511,000 short tons

n.a. = Not available.

STATISTICAL SUMMARIES, CONT. (BASED ON DATA FROM CENSUS BUREAU)

PAPER COATING & GLAZING (SIC Code 2641)

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1982	579	45,800e	$5,250	$194
1981	—	45,900e	5,146	200
1980	—	45,800	4,688	175
1979	—	49,800	4,230	151
1978	—	41,300	3,746	91
1977	529	39,700	3,392	99
1976	—	39,300	3,074	92
1975	—	36,600	2,626	108
1074	—	40,800	2,645	84
1973	—	39,300	2,285	70
1972	426	37,200	1,954	52
1971	—	38,400	1,832	42
1970	—	38,300	1,750	77

Paper consumed (estimated):

1982: n.a.
1977: 1,562,200 short tons
1972: 1,352,000 short tons

BAGS, EXCEPT TEXTILE BAGS (SIC Code 2643)

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1982	575	50,100	$5,016	$138.5
1981	—	54,700	5,613	165.7
1980	—	54,900	5,215	163.6
1979		52,700	4,579	129.7
1978	—	49,500	3,926	135.1
1977	596	48,700	3,482	93.4
1976	—	50,700	3,380	93.9
1975	—	48,800	2,980	94.5
1974	—	51,600	2,867	65.5
1973	—	49,500	2,183	51.8
1972	583	48,600	1,886	53.9
1971	—	50,300	1,772	94.9
1970	—	53,200	1,711	81.4

Paper consumed (estimated):
1982: 3,279,000 short tons (1,874,000 tons is purchased on the open market)
1977: 3,178,000 short tons
1972: 2,616,000 short tons

1. Includes polyethylene bags and sacks.

n.a. = Not available.

SETUP PAPERBOARD BOXES

Also called nonbending paperboard, these are containers in rigid form, as compared to a folding or collapsible box. They can be made from solid or combination board depending on the style of the container. They range in thickness from 0.016 to 0.065 in. and weigh 60 to 206 lbs/1,000 ft^2.

Stiffness, rigidity, and resistance to abuse are essential qualities. Rigid boxboard can be laminated or pasted together to form nonbending boards of greater thicknesses. It can be made from plain chipboard, filled newsboard, single new vat-lined chipboard, or single white vat-lined chipboard. Setup paperboard is usually made from a cheaper grade of wastepaper than folding cartons because it is not subject to scoring and bending.

After six consecutive years of declining real growth (1976-82), the value of shipments of setup boxes increased by an estimated 7% to $441 million. The turnaround was attributed to improved economic conditions and increased consumer disposable income and spending, as well as to increased efforts by the industry to expand into new market areas, according to BIE.

The number of setup box production facilities over the past 20 years has declined dramatically from more than 800 plants in the early 1960s to about 250 plants in 1983. In addition, rigid-box makers have significantly diversified their product end-uses. Many now also make folding cartons.

The real value of setup boxes is expected to rise by an annual compounded rate of 1.5%, provided the industry continues to adapt its packaging products to new markets and the economy remains healthy. Setup boxes will be challenged by folding cartons and plastics in some of their traditional markets, but are expected to retain their share in high value, specialty packaging.

FIBER CANS, DRUMS AND TUBES

Composite cans, tubes and cores are produced by the spiral or convoluted winding of paperboard strips around a core or mandel. The paperboard can be recycled board, kraft paperboard, or semichemical board. Strength is produced by the use of two or more plies. If special barriers are required, the board is first laminated with plastics or foil or coated with hotmelts and other specialty coatings. An adhesive such as dextrine is applied to the strips during winding. The endless formed tube is cut on a mandel to desired sizes. For composite cans, either metal or plastic caps are used to seal the ends.

Composite cans are used to package a number of food and nonfood items such as frozen fruit juices, motor oils, snack foods, adhesives, etc. The market has matured in the last few years, mainly because composite cans have not been able to penetrate new high-volume packaging areas, such as occurred in the 1960s for motor oil and juices. In addition, the motor oil segment of the market has come under increasing competitive

SANITARY PAPER PRODUCTS (SIC CODE 2647)

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1982	137	36,100	$9,077	$270.9
1981	—	36,600	8,346	248.2
1980	—	37,700	7,636	250.9
1979	—	37,700	6,615	265.4
1978	—	35,000	5,591	210.6
1977	120	34,500	4,921	199.1
1976	—	32,900	4,410	108.4
1975	—	31,400	3,884	121.2
1974	—	31,300	3,265	65.2
1973	—	28,200	2,325	109.0
1972	108	26,300	2,072	119.6
1971	—	24,000	1,716	52.9
1970	—	24,600	1,654	50.5

Paper consumed (estimated):

1982: 3,589,000 short tons (of which 383,000 purchased on the open market)
1977: 3,651,000 short tons

SHIPPING SACK END-USE MARKETS

(millions of sacks)

End-use	1982	1983e	% change 1983/82
Livestock, poultry feed	456.9	473.6	4
Chemicals[1]	288.6	307.1	6
Fertilizers	165.4	180.1	9
Dog and cat food	206.7	214.2	4
Clays	140.7	118.4	−16
Flour and flour mix	130.9	131.0	0
Plastic materials	126.6	124.5	−2
Seeds	174.1	156.6	−10
Insulation	66.6	54.8	−18
Portland cement	91.8	91.9	0
Cement, mortar mix	104.5	131.7	26
Salt/water softeners	122.0	119.1	−2
Limestone	115.6	109.1	−6
Masonry cement	54.8	73.6	34
Sugar	67.1	62.3	−7
Absorbents	54.5	63.7	17
Other	749.1	763.3	2
TOTAL	3,115.9	3,175.0	2

e = Estimate.
1. Excludes fertilizers, plastic materials and salt.

Source: Paper Shipping Sack Manufacturers Assn.

pressure from plastic bottles in recent years. Some forecasters predict that plastic bottles will capture as much as 50% of the market in a few years. The industry has been active in promoting new designs, such as the single-wrap composite can, to open new high-volume markets. Aseptic composite cans are one new area of development.

On the basis of sales, the approximate market shares for composite cans are: (1) frozen concentrated juices, 16%; (2) other food products, including frozen fruits, refrigerated dough products, powdered drinks, and snack foods, 32%; (3) motor oil, 39%; and (4) other nonfood products, 13%.

The core, tube and drum markets have shown reasonably good dollar-value growth, but growth measured by other indicators, such as paperboard consumption, has been slow or negative. A large part of the production of this industry is captive, being produced onsite at paper mills or converting plants.

BAGS (EXCEPT TEXTILE): SHIPMENT AND TONNAGE BY TYPE

	1982	1977
Grocers bags and sacks		
Product shipments, $ million	917.1	612.6
Paper consumed, 000 tons	1,913.1	1,699.0
Variety (merchandise) bags		
Product shipments, $ million	152.6	139.7
Paper consumed, 000 tons	212.8	255.1
Shopping bags (uncoated)		
Product shipments, $ million	37.4	33.2
Paper consumed, 000 tons	30.0	42.0
Other paper bags		
Product shipments, $ million	56.8	12.3
Paper consumed, 000 tons	56.1	21.9
Specialty bags & liners (coated)		
Product shipments, $ milion	200.3	210.6
Paper consumed, 000 tons	148.9	n.a.
Shipping sacks (single & multiwall)		
Product shipments, $ million	846.5	658.8
Paper consumed, 000 tons	925.3	997.6

Polyethylene grocery and variety bag tonnage was estimated at 133,000 tons valued at $267.8 million in 1982. Plastic shipping sack: 22,000 tons valued at $38.6 million.

Source: Bureau of the Census.

MOLDED PULP PRODUCTS

Molded pulp products are considered to be a converted product, the smallest of the domestic paper and converting sectors, according to the Bureau of Industrial Economics. The product is made in a unique wet-forming process invented around the turn of the century.

The number of molded pulp producers has remained relatively small, with 85% to 90% of the industry's capacity held by just four producers. BIE reports the number of molded and pressed pulp manufacturing sites has dropped by more than one-fourth over the past decade to 31 facilities in 1982, with 11 having fewer than 20 employees.

Molded pulp products are made directly from pulp. Fibers are drawn from a liquid slurry onto preformed molds either by vacuum suction or cloth covers that catch the fibers. The maximum possible amount of water—usually 25% to 30%—is first removed mechanically, then the molded pulp is either passed through heated tunnels or pressed between heated dies. Molding, pressing and drying are done in a continuous process.

The furnish is short-fibered, derived either from clean grades of wastepaper or groundwood and hardwood sulfate pulps. The secondary fiber or market pulp is first slurried in a conventional pulper, refined, sized, and then formed.

MARKETS

Molded pulp products are classified into five categories, including: (1) consumer, (2) food service, (3) retail food packaging, (4) food distribution, and (5) specialty products. These items should not be confused with solid bleached paperboard products, called pressed board, which are machine-stamped, or pressed, into a form such as a dish or tray (see chapter on solid bleached paperboard.)

The primary market for molded pulp products is in the consumer sector. Retail food packaging—particularly egg cartons—and food distribution—especially egg trays and fruit packaging trays—are also major markets for molded pulp products.

Consumer products such as disposable tableware are sold in retail stores directly to the consumer. Pressed paperboard reportedly dominates this market, with molded pulp products having the second largest share, and plastics trailing behind with a very small portion of the market.

During the 1970s, competition from plastics cost the pulp and paper industry significant losses in a number of traditional paper markets, including food prepackaging trays (especially meat and fresh produce), egg cartons and fiber pipe. Plastics and molded pulp now each have about a 50% share of the egg carton market. It is not known how much of the meat and produce tray business has been lost to plastics, but it is reportedly

STATISTICS OF U.S. PRESSED AND MOLDED PULP INDUSTRY

	Number of establishments*	Employees (000)	Value of shipments ($ million)
1984e	—	3.3	—
1983e	—	3.1	234
1982	31	3.1	237
1981	38	3.2	239
1980	—	4.4	225
1979	—	4.6	220
1978	—	5.0	226
1977	38	4.9	240
1976	—	5.3	218
1975	—	5.3	210
1974	—	5.6	205
1973	—	5.6	168
1972	49	6.1	163
1967	58	6.7	146

e = Estimate.
* Data from Census of Manufactures.

Source: Bureau of the Census.

extensive. Bituminous fiber pipe for uses such as sewer and drainage pipe, conduit and fittings, has been almost totally displaced by plastics, according to observers.

Molded pulp shipping trays are sold to food distributors for packaging fragile products such as eggs and fruits so they will not be bruised or broken. The rigidity and absorbency as well as the cushioning capabilities of molded pulp trays are considered to make them ideal protective containers for perishables.

They are also used for packaging products such as fluorescent light bulbs, wine bottles, toiletries, electronics, and pharmaceuticals. Specialty uses for molded pulp include stereo speaker horns, helmet linings, luggage shells, and flower pots made from pulp and peat moss.

The drop in demand for nursery products for landscaping, which was caused by the erosion in the construction industry in the early 1980s, reportedly drove a number of specialty molded pulp producers out of business.

In 1972, BIE reported 49 locations at which molded and pressed pulp was being made, compared with 38 in 1981. This decline appears to be continuing. Two of the major producers are Keyes Fibre Co. and Packaging Corp. of America.

Diamond International Corp. (acquired in 1982 by Sir James Goldsmith, who later began selling off its assets), formerly one of the top producers, sold the Red Bluff, Calif., and Plattsburgh, N.Y., plants to Packaging Corp. of America in 1983. The Middletown, Ohio, plant has been closed for some time and remains shut, with no plans to reopen it. PCA has an option to purchase the Palmer, Mass., molded pulp facility, but has not yet exercised its right.

The value of shipments of molded and pressed pulp products declined an estimated 1% in 1983 to $233.9 million, according to BIE. The industry has continued to shrink during the past decade, primarily due to competition from plastics, especially in the food serving areas such as egg cartons and meat/produce trays, floral and other decorative items, and piping. From 1972 to 1983, the compound annual rate of decline was 3.9%, according to BIE.

Imports are expected to continue to exceed exports of molded and pressed pulp products in 1984, with exports projected at $5.9 million compared with $44.4 million in imports, according to BIE. In 1983, U.S. exports of pressed and molded pulp goods reached $5.2 million, a 4% increase over 1982. Principal markets were Canada and Mexico. In the same year, the U.S. imported a total of $43.5 million worth of molded and pressed pulp products. Imports—mostly from Taiwan, Mexico, and Japan—consisted of paper-mâché and similar goods manufactured at a lower cost abroad, according to BIE.

In a challenge to Canadian competition, Keyes and PCA charged Canadian producers Cascades Inc. and Fripp's Fibre Form Ltd. with dumping egg filler flats in the U.S. since 1980. Late in 1984, the U.S. Dept. of Commerce was investigating the allegation.

OUTLOOK

The value of shipments of pressed and molded pulp goods for 1984 is expected to be 1% below the 1983 figure, primarily due to loss of sales to plastics, which are cost-competitive and have certain physical advantages such as lighter weight and better moisture resistance, according to the bureau.

Pressed and molded pulp producers feel some markets will grow by 5%/year or more for the next few years, and are actively pursuing ways to compete with plastics in traditional markets as well as forge new markets. It is felt that the volatility of oil prices is likely to weaken the hold of plastics on the market, since plastics are petroleum derivatives. Generally, it is

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U.S. PRESSED AND MOLDED PULP PRODUCERS

1. CKF Inc. (Affil. of Minas Basin Pulp & Power co. Ltd.)
   Hantsport, N.S.

2. Diamond International Corp.
   Natchez, Miss[1]
   Palmer, Mass.[2]

3. Fibre Form Corp.
   Columbia City, Ind.

4. Henry Molded Pulp Products Inc.
   Lebanon, Pa.

5. Keiding Inc.
   Milwaukee, Wis.

6. Keyes Fibre Co.
   Waterville, Maine
   Sacramento, Calif.
   Hammond, Ind.
   Albertville, Ala.
   Wenatchee, Wash.

7. Les Materiaux Cascades Inc.
   Kingsey-Falls, Que.

8. Packaging Corp. of America
   Macon, Ga.
   Griffith, Ind.
   Red Bluff, Calif.[3]
   Plattsburgh, N.Y.[3]

9. Reid Dominion Packaging Ltd.
   Brantford, Ont.

10. Woodstream Corp.
    Lititz, Pa.

[1] Mill closed.
[2] Packaging Corp. of America has option to buy.
[3] Sold by Diamond International Corp. in 1983.

thought the market will remain relatively flat because of some losses to plastics and some gains in other areas.

Since the pulp-based tray is expected to cost less (because it requires fewer manufacturing steps) than the paperboard trays now becoming highly successful in microwave cooking applications, the pulp product may penetrate this market in the near future, according to BIE. Industry observers agree with government forecasters that one of the most promising new markets for molded pulp products is in ovenable trays which can be used in both conventional and microwave ovens. Such producers as Keyes Fibre Co. and Packing Corp. of America are in this market. The total ovenable market is still small, however—projected to rise to about 20,000 tons for all materials in 1985.

But the long-term prospects are good. A number of major frozen food manufacturers are using these trays, and demand reportedly increased by as much as 25% for some end-uses this year, according to one industry observer. Approximately one billion units of ovenable trays—of which about 60% were paperboard—were sold in 1983, up more than 50% from five years earlier, according to one account.

BIE feels the industry's share of the domestic market for food service containers and utensils will continue to decline during the 1984-88 period. The average annual rate of decline is projected at 2%, which will be an improvement over the much steeper annual decline during the 1970s, BIE estimates. This is based on the assumption that the industry will partly succeed in developing new end-use markets. New technology is being developed to adapt pulp trays for use in microwave cooking.

Producers also remain enthusiastic about the growth in the fast food industry, which they see as a promising future market for molded pulp carryout trays, as well as in the area of food processing for fast food outlets and institutions. But, though those markets are expected to grow significantly, volume will probably be small relative to the more substantial markets for egg cartons and trays and disposable tableware.

Industry executives are also optimistic that a projected rise in produce sales—especially the Pacific Northwest apple market—will boost the demand for molded pulp shipping trays. One observer, though, said apple capacity may exceed demand unless exports are increased. But if the market continues to expand, it appears likely that packers will stay with their preference for molded pulp over plastic for trays used in long-distance shipping, both domestically and overseas, and molded pulp is expected to gain an increasing chunk of this market.

TYPICAL MOLDED PULP PRODUCTS BY END-USE

Consumer products

Tableware
Plates
Dishes

Food service

Plates
Trays (bottle, food, etc.)
Carry-out containers

Food distributors

Egg cases
Egg trays
Fruit packs

Food packaging

Egg cartons
Meat trays
Poultry trays
Cake circles

Specialty

Florist vases
Flower pots
Seed pots
Interior packaging
Minnow buckets

ELECTRONIC COMPETITION

Little green electron tubes and microchips pose a serious threat to long-term demand for printing and publishing papers, Japan's Ministry of International Trade & Industry believes. But the agency concluded in recent studies that papers used to print output of copiers and computers will jump in popularity in the years ahead.

Not all observers agree with all the MITI assessments. For example, while MITI feels books, newspapers and direct mail are extremely vulnerable to competition from electronic media, Jaakko Pöyry International Oy chairman Jaakko Pöyry told a Mexico City, Mexico, audience that "the trend is toward more paper being consumed rather than less. Books, magazines and newspapers will retain their unique and widely appreciated qualities."

No newsprint impact yet. The one thing that all observers still agree on is that electronic communications media so far have boosted paper use more than retarded it. Dr. David Wilson of the Canadian Pulp & Paper Assn. recently told a Duke Univ. audience that "there has so far been no widespread acceptance [of electronic newspapers] and no impact on newsprint consumption." And about the only sector of the paper industry that can point to electronic media as having influence on its end-use markets so far is the bond and copy paper sector, where increasing numbers of copiers and computer printers use more and more paper.

Public discussion of the question of electronic media and paper demand has died down in the last year or two, for a good reason: nobody has ever been able to get a reliable, quantitative grip on what such media have meant for the paper industry so far, much less predict the future. As Pöyry said in his speech to the Congress of the International Publishers Assn., "to forecast innovative services 20 years into the future on the basis of perhaps only 15 years of data does not inspire confidence."

And yet that is precisely what MITI and CPPA's Wilson have done in an informal way—and without pretending to be psychic. Wilson focused on newsprint

POTENTIAL OF TELETEX ON MAJOR PRINTING PAPER GRADES

Paper grade	Potential impact—positive	Potential impact—negative
COATED PAPERS		
Coated groundwood	Magazines, brochures,	
Coated free sheet	promotional advertising operating manuals, books	—
Thermal papers	Printer output	—
UNCOATED PAPERS		
Uncoated groundwood	Videotex directories	White telephone directories
Newsprint	—	Decline in classified use
Forms bond	Printer ouptut	—
Uncoated free sheet (other)	Books, operating manuals	—
Check paper	—	Less check use

Source: St. Regis Corp.

in his Duke Univ. talk before the Conference on Canada/U.S. Forest Products Trade, while MITI, in a series of studies on impact of electronic media on various industries, looked at a range of paper grades. The MITI studies were discussed in the April 1984 issue of the *JP News Letter*, published by Japan Pulp & Paper Co.

Directories and schedules. The JP write-up of the MITI studies noted that "there is a very big possibility that encyclopedias, telephone directories and train schedules will be replaced by videotex and electronic files." It noted that "in these fields where data renewal is necessary, this new medium is better suited than printed media."

The picture for directories may not be as simple as that, however. St. Regis Corp., in its corporate planning department's quarterly *Business Outlook* publication for March 1984, noted that "the outlook for directory paper seems to be . . . clouded. On the one hand, its use as a communication medium could be sharply curtailed, when and if videotex services become providers of this basic data. However, this could be partially offset if specialized printed directories are produced to support each service as it is are introduced."

According to MITI, other effects of electronic competition could be felt by how-to books going over to video disk, textbooks switching to interactive video systems, and improved computerized warehousing which reduces overproduction of books by publishers. However, St. Regis pointed out that the spread of videotex may also create a need for newsletters and magazines to provide information about the new services.

The JP writeup said, on the other hand, that book publishers will notice a continuation of the "trend of decreased reading that is especially apparent in the young generation," with new media further eroding young people's acceptance of books, with the result that "novels and other literature will be affected very much by new media."

End to newsprint growth. MITI pointed to real estate and help-wanted advertising as the best candidates for conversion to electronic media from newspapers. These services would have to be distributed by home computer or by special one-way or two-way (interactive) devices on television sets.

St. Regis noted that "the future fate of teletext [one-way systems generally using home television sets and transmitting a very limited amount of information] will probably rest with its inclusion into the architecture of

MAJOR GRADES OF PAPER THAT MAY BE AFFECTED BY ELECTRONIC COMPETITION: U.S. PRODUCTION

(000 short tons)

	1970	1975	1980	1983
Newsprint[1]	12,200	11,400	14,400	14,500
Groundwood specialties				
Directory[2]	200	300	450	450
Catalog[2]	250	300	375	425
Groundwood forms	*	75	230	240
Groundwood book	155	130	130	125
Uncoated free sheet				
Forms bond	720	950	1,500	1,700
Envelope stock[3]	470	460	660	700
Offset book	1,400	1,450	2,000	2,100
Bond and writing	700	1,000	1,800	1,840
Tablet	350	230	325	400
Coated paper				
Nos. 1 to 4, two-side	950	1,200	1,800	2,300
No. 5, two-side	1,950	1,650	2,400	2,960

* Not applicable.

1. North American production.
2. Numbers reflect estimated U.S. consumption, not production. Estimates for production not considered reliable.
3. Does not include uncoated free sheet purchased by envelope makers without specific knowledge of mills, estimated at about 200,000 tpy. Also does not include brown, bleached or semibleached kraft envelopes, estimated at about 225,000.

Source: PULP & PAPER estimates.

the television set. Several set manufacturers will be offering a teletext option (probably at an additional cost of $100) at some time in the near future. Once in place, it should open up opportunities for many companies to develop services via this new mode of communication."

Andover International Associates' Peter Oliver, in April remarks before the FAO (Food and Agriculture Organization of the United Nations) Newsprint Working Party in Montreal, Que., chose to analyze newsprint impact by looking at delivery systems and concluded that interactive home information systems may be reaching the takeoff point. The home computer market now represents less than 5% of all homes, he said, but by 1990 that penetration could reach 30% to 50%, with "at least half of the installations using interactive consumer services." Penetration would then start to increase rapidly, with 60% possibly being reached by 1993.

Assuming that kind of activity, Oliver cited estimates that would cause daily newsprint demand in North America to become stagnant in the 1990s, with nonnewspaper demand leading to an overall 1.2%/year newsprint demand growth. In western Europe, demand in the next decade would rise by just 0.3%/year, while in the rest of the world, with negligible impact from electronic systems, it could still be growing at between 2.6% and 3.5%/year. Cumulative worldwide growth rate, then, would be about 1.8%/year.

CPPA's Wilson assumed, in attempting to develop a long-term scenario of North American newsprint trade, that "growth of newsprint consumption will cease around the middle of the decade of the nineties." He also assumed "growth of consumption of newsprint will not be affected to any measurable degree for the next ten years or so." He cautioned that in the lack of better information, "any [such] allowance must be arbitrary."

Make direct mail obsolete. Other grades discussed by the JP writeup included those involved in direct mail. "Facsimile, video disk and teletext will make direct-mail obsolete in the near future," it claimed, adding that "in the 1990s demand will be 40% of what it is today." Some catalogs may continue to serve home shopping needs, however, "in conjunction with electronic media."

MITI also expects electronic files and electronic mail to hurt use for ledger and letter paper. On the other hand, the studies show a major benefit to "input papers" such as perforation tape, punch card paper, and optical and magnetic character recognition papers. And they show big gains possible for computer forms, copy paper, carbonless, heat-sensitive, electrostatic and aluminum metalized paper.

In one study of paper used by computer printers in Japan, it was found that between 1969 and 1980, paper consumption per computer dropped to a quarter of its initial level. But because the number of computers in place rose by 12 times, volume of paper used more than tripled.

Heat-sensitive coated paper. Types of paper used will change in the future under the influence of computers. Some of those new grades of paper may become extremely important, too. As Jaakko Pöyry noted, a "wired household," with home computer, printer and electronic entertainment center in one, may replace "to a large extent newspapers, magazines, games, reference catalogs, indexes and a variety of other things." Such home systems are likely to employ special papers, such as heat-sensitive coated, to reduce printer costs.

The St. Regis report also cited thermal imaging papers for inexpensive home printers as well as forms bond for office printers as major beneficiaries of electronic media developments.

WORLD REVIEW

The world's pulp and paper industry saw the first signs of a much-needed recovery in 1983. The pickup in demand began in the U.S. in midyear and had spread to most other countries by end-1983. Several countries, including the U.S., Japan, Sweden and Fed. Rep. Germany, set new annual records for paper and board output. Recovery continued into the first half of 1984 with pulp and paper price rises succeeding in most major markets.

After falling 1.9% in 1982, world paper and board production rose 6.4% in 1983 to reach an all-time record of 177 million tons. Pulp output was up 6.7% at 131 million tons (after a 1982 drop of 4.4%). Consumption of paper and board rose 6.1% to 177 million tons, with average per capita consumption at 85.5 lb (38.8 kg).

The estimated number of paper mills in the world rose by 39 to 6,010 (reported by *Pulp & Paper International*, Aug. 1984) but the world's papermaking capacity dropped by 0.2% (456,000 tons) to 198 million tons. Pulp production capacity declined even more, by 2.6% (just over four million tons) to 148 million tons, and the total number of pulp mills fell 15 to 1,411.

All the main regions of the world had higher output of pulp and paper, with the exception of Australasia, where Australian production fell below the previous year, partly because of a severe drought. Another bad drought affected the South African industry, where total paper and board production also declined.

U.S. LEADS THE WAY

The world's biggest producer and consumer of pulp and paper led the way back to profitability, and the strong U.S. dollar continued to be a dominating factor on international markets. The U.S. turnaround began in mid-1983 with a surge in orders, mostly for printing/writing grades. The producers of most grades were easily able to push through price increases as the year progressed.

The economic recovery that drove the improvement in the pulp and paper business was also sufficiently strong to enhance the fortunes of most major international paper companies. The Swedish industry in particular enjoyed a real boom year, helped in the export markets by its currency devaluation at end-1982 and the strong U.S. dollar.

Total Norscan market pulp shipments reached a record level of just over 16 million tons in 1983, nearly 19% above the previous weak year. The average 1983 operating rate, at 87.6%, was 10 points above 1982. The pulp market gradually improved through 1983 with some successful price increases. It was not, however, a steady improvement, and some suppliers had trouble holding sales to list prices. Despite the record Norscan shipments, the market still looked uncertain in early 1984, but got a boost from the two-and-a-half-month shutdown of market pulp mills in British Columbia, Canada.

Still too much newsprint. World newsprint production in 1983 recovered from a 3% drop in 1982, to reach 25.9 million tons, 3% over 1982. But newsprint remained the weak sector of the paper industry, mainly because of continuing oversupply. And new newsprint production capacity is due to come online over the next few years, particularly in Europe.

Printing/writing papers, on the other hand, enjoyed considerable demand growth in 1983, which continued into 1984. Many magazine grades, including lightweight coated, were on allocation up to at least mid-1984 in both U.S. and western Europe. The output in 1983 of printing/writing grades was 43.7 million tons, an increase of 7.8%.

In the **packaging paper and board** sector, 59.4 million tons were produced in 1983, a 6.4% increase over 1982, which more directly reflected the general increase in manufacturing output in 1983 by most of the bigger countries. **Kraft linerboard** prices remained depressed in 1983, causing the European Economic Community to enforce minimum price levels to avoid dumping. Dumping was also reported in Asian markets. The high dollar rate, coupled with weak local currencies, meant that European producers got the better of U.S. linerboard mills by following the downward price trend.

The economic pickup raised demand, however, and from mid-1983 to mid-1984 linerboard prices rose 22% in dollar terms, nearly 40% when expressed in major European currencies.

Brazil and South Africa are set to become important linerboard exporters to world markets, with extra capacity coming onstream in 1984-85.

In this review, data from all countries, including the U.S., are reported in metric tons. All data conform with FAO definitions: thus, paper/board totals do not include insulation board; pulp figures exclude screenings, defibrated, and exploded pulps.

1984 OUTLOOK FAIR

The pulp and paper business improved even more during first-quarter 1984, with two successful market pulp price hikes going through in both the U.S. and Europe, while paper prices also climbed in most of the big producing nations. The closure of western Canadian mills during the quarter helped strengthen both pulp and newsprint markets and secure price increases. By mid-1984, many producers were confident that new output levels could be reached by year-end. Others were seeing the first signs of a slowdown in demand and wondering if the recovery would last to the end of the year.

EUROPE

The year 1983 was one of recovery for the European paper industry with production, consumption and profits all improving over 1982 levels and drawing closer to the 1981 position. It was obvious from the third quarter that the economic pickup in the U.S. was making its effects felt on the other side of the Atlantic.

Paper and board output in the nine EEC producing states (Luxembourg does not make any paper) rose moderately in 1983, up 1.9%, to 24.1 million tons, while pulp output rose 3.6% to 5.5 million tons. In the East European bloc, paper and board production was up 4.3% at 16.1 million tons, and pulp output rose 4.8% to 12.3 million tons.

While paper and board production in all of Europe (East and West) rose 3.9% in 1983, pulp output rose 6.5%. By far the greatest production increases took place in **Scandinavia** as the joint Finnish, Norwegian and Swedish output of paper and board reached 14.1 million tons, up 7.5%. Scandinavian pulp output rose by an impressive 9.5% to 17.4 million tons.

Reflecting their improved output performance, and coupled with the international market upswing, forest product companies in Sweden reported total 1983 earnings of $630 million on sales of $6.685 billion. The Swedish Pulp & Paper Assn. forecast that the total value of forest industry exports in the mid-1984 to mid-1985 period would reach $6.433 billion.

Fed. Rep. Germany continues to be Western Europe's biggest paper/board producer, with a record 1983 output of 8.27 million tons (7.78 million in 1982). Finland came second, with 6.38 million tons (vs 5.89 million in 1982), and Sweden third with 6.35 million (5.91 million in 1982).

CAPACITY INCREASES

Among the major expansions in Europe in 1983 were: a 200,000-tpy sulfite market pulp mill in Czechoslovakia; a 160,000-tpy newsprint machine plus a 1,330-tpd pressurized groundwood line at Tampella AB's Anjala mill, in Finland; a 160,000-tpy fine paper machine at Kymi Kymmene in Finland; a similar paper machine at the Svetogorsk combine in Karelia, U.S.S.R.; a corrugating medium machine at Kombinat Belišće-Bel, Yugoslavia; and a 150,000-tpy newsprint machine at Gebr. Lang, Fed. Rep. Germany.

The 1984-85 period will see much more capacity coming onstream. The cost of 1984 pulp and paper mill expansion investments in Europe alone is put at $1.340 billion.

Among the biggest expansions planned in Europe for 1984 are: a 170,000-tpy linerboard and liquid packaging board machine at Nettingsdorf Papierfabrik AG, and a 150,000-tpy newsprint machine at Steyrermühl Papierfabrik AG, both in Austria; the 300,000-tpy market pulp mill of Soporcel (Sociedade Portuguesa de Celulose) in Portugal; a 60,000-tpy printing/writing grades machine at Szolnok in Hungary; and a 75,000-tpy printing/writing paper machine at Kwidzyn in Poland.

In mid-1984, some big capacity expansions were announced for Sweden. They include: a new 180,000-tpy newsprint machine at Holmens Bruk's Braviken mill for September 1985 startup; a 210,000-tpy newsprint machine at Svenska Cellulosa AB's Ortviken mill for February 1986 startup; a 125,000-tpy uncoated free-sheet machine at MoDo Papper AB's Husum mill for October 1985 startup; and a 225,000-tpy liquid packaging board machine at Billerud AB's Gruvön mill for December 1986 startup.

PRODUCTION BY CONTINENT, WORLD TOTAL (000 metric tons)

	PULP				
	1960	**1970**	**1980**	**1982**	**1983**
North America	32,964	54,912	65,969	61,762	66,882
Europe	20,965	34,853	40,235	36,858	39,271
Asia/Australasia	5,156	14,268	18,239	17,308	17,658
Latin America	821	2,224	5,848	5,162	5,539
Africa	124	900	1,502	1,720	1,772
World total	**60,031**	**107,157**	**131,793**	**122,810**	**131,122**

	PAPER AND PAPERBOARD				
	1960	**1970**	**1980**	**1982**	**1983**
North America	38,917	58,914	70,225	66,373	72,202
Europe	25,634	45,159	59,023	58,181	60,508
Asia/Australasia	7,861	20,621	31,962	32,334	34,646
Latin America	1,656	3,712	7,737	7,815	8,092
Africa	288	892	1,717	1,826	1,828
World total	**74,355**	**129,298**	**170,664**	**166,529**	**177,276**

EEC CONCERN ABOUT IMPORTS

With many of Europe's capacity expansions coming from outside the ten EEC nations, the EEC paper industry reacted nervously to what it saw as a possible tidal wave of high-quality, duty-free (since Jan. 1, 1984) paper flooding the EEC market from countries in the European Free Trade Assn. (EFTA). The EEC paper industry confederation, Cepac, announced it was watching developments closely and would prepare regular reports on import levels. Cepac's main message to the big Scandinavian producers is that they should make their export efforts on a worldwide basis, not just concentrate them in the EEC.

A dispute between the EEC and Canada over the level of Canadian duty-free newsprint exports to the EEC in 1984 was referred to the General Agreement on Tariffs & Trade regulation body in Geneva for a ruling, expected to be announced in late-1984. In addition, the EEC investigation into an alleged market pulp cartel continued without solutions in sight. Possible changes in the U.S.-dollar-based system for sales of market pulp in EEC are being examined by lawyers from the EEC Commission and major market pulp companies.

NORTH AMERICA

The economic recovery, which took firm hold in the U.S. about mid-1983, brought a surge of response for the pulp and paper industry in North America in the second half of the year. It was enough to result in new output records in the U.S. and bring the industry in Canada back to good operating levels by end-1983.

Total North American output of paper and board in 1983 soared by 8.8% to a record 72.2 million metric tons. The magnitude of the recovery is even better seen in the absolute tonnage increase—almost six million tons—which is equivalent to the annual output of Sweden or Finland.

Led by an 11% surge in output of printing and writing grades, **United States** mills produced 58.85 million tons of paper and board, 4% over the previous high set in 1981. Significantly, production ran at an average annual rate of some 62 million tons during the last four months of the year, compared with only 57 million tons during the first half. Total pulp output rose 6.5% to 47.7 million tons, while market pulp output jumped 13% to a new record 5.9 million tons.

In **Canada**, the turnaround in market pulp shipments was even more dramatic, up 18% over 1982, but short of the previous record set in 1981. Similarly, although Canada's newsprint mills were operating at good rates by year-end, total shipments were up only 5% to 8.45 million tons, far off the 1981 record of 8.9 million tons. Canada's overseas newsprint exports actually dropped 7%, due to sluggish demand in Europe and weak economic conditions in Latin America, according to Canadian Pulp & Paper Assn. However, Canada's overseas exports are also certainly being affected by the increased capacity added in Europe (Fed. Rep. Germany and the U.K.) during the past 18 months, by self-sufficiency projects in several Latin American countries, and by the advent of South Africa as a new newsprint

WORLD'S TOP PRODUCING AND CONSUMING COUNTRIES

PAPER AND BOARD PRODUCTION (000 metric tons)			PULP PRODUCTION (000 metric tons)			PER CAPITA CONSUMPTION (lb/year)		
	1983	% change 1983/82		1983	% change 1983/82		1983	% change 1983/82
1. U.S.	58,849	9.1	1. U.S.	47,661	6.5	1. U.S.	589	6.8
2. Japan	18,442	5.7	2. Canada	19,221	13.0	2. Sweden	467	5.0
3. Canada	13,353	7.6	3. Japan	8,860	2.7	3. Canada	414	7.4
4. U.S.S.R.	9,556	6.4	4. Sweden	8,668	12.5	4. Denmark	373	1.8
5. Fed. Rep. Germany	8,272	6.3	5. U.S.S.R.	7,913	6.3	5. Finland	370	5.0
6. People's Rep. China	6,613	12.3	6. Finland	7,163	6.7	6. Switzerland	362	5.1
7. Finland	6,388	8.4	7. People's Rep. China	4,725	6.4	7. Fed. Rep. Germany	353	5.3
8. Sweden	6,350	7.3	8. Brazil	2,917	0.7	8. Netherlands	348	3.9
9. France	5,261	2.6	9. Fed. Rep. Germany	2,081	3.8	9. Japan	337	4.8
10. Italy	4,259	-6.9	10. France	1,862	5.5	10. Belgium	335	6.3
11. Brazil	3,420	3.2	11. Norway	1,640	7.8	11. New Zealand	324	2.8
12. U.K.	3,209	0.3	12. Spain	1,412	3.8	12. Norway	287	—
13. Spain	2,754	2.6	13. Austria	1,169	-1.7	13. Australia	280	-5.9
14. Mexico	2,062	3.8	14. South Africa	1,165	—	14. U.K.	278	5.9
15. Korea, Rep.	1,982	14.1	15. New Zealand	1,073	3.2	15. France	267	3.4
16. Austria	1,789	4.8	16. Portugal	1,042	9.5	16. Hong Kong	262	-0.8
17. Netherlands	1,737	6.4	17. Czechoslovakia	977	1.8	17. Austria	240	4.8
18. Taiwan	1,720	10.5	18. Poland	871	7.1	18. Iceland	225	13.3
19. Australia	1,451	-3.0	19. India	850	—	19. Singapore	212	43.3
20. Norway	1,368	4.9	20. Romania	845	3.7	20. Taiwan	203	5.7

WORLD PULP, PAPER, AND BOARD

	Population (000)	Number of mills		CAPACITY (000 m tons)		Per capita (lb)	CONSUMPTION (000 m tons)				PRODUCTION (000 m tons)			
							P&B		Pulp		P&B		Pulp	
		P&B	Pulp	P&B	Pulp		1982	1983	1982	1983	1982	1983	1982	1983
EUROPE														
Belgium	9 900	16	3	1 279	342	335 1	1 411	1 505	588	614	827	837	323	326
Denmark	5 116	6	3	375	135	373 7	850	867	154	178	279	319	111	111
France	54 000	165	26	5 500	2 250	266 1	6 292	6 516	3 115	3 210	5 127	5 261	1 765	1 862
Germany Fed Rep	61 421	206	37	9 091	2 125	352 5	9 371	9 822	4 311	4 713	7 783	8 272	2 004	2 081
Greece	9 700	19	4	385	65	104 1	445	458	155	195	280	273	43	45
Ireland	3 200	2	0	50e	0	186 1	270e	270e	20e	20e	20	20	0	0
Italy	56 800	430	30	5 350	1 050	190 0	4 884	4 854	2 155	2 125	4 574	4 259	816	767
Netherlands	14 360	35	3	1 878	152	348 3	2 177	2 256	625	643	1 633	1 737	136	147
United Kingdom	55 950	102	3	3 497	126	278 7	6 750	7 070	1 489	1 654	3 198	3 209	141	173
EEC	**270.447**	**981**	**109**	**27.405**	**6.245**	**274.0**	**32.450**	**33.618**	**12.612**	**13.352**	**23.721**	**24.187**	**5.339**	**5.532**
Finland	4 857	46	51	7 550	8 872	370 3	1 105	1 182	5 312	5 623	5 895	6 388	6 714	7 163
Norway	4 130	23	27	1 785	2 170	286 6	527	533	1 249	1 243	1 304	1 368	1 522	1 640
Sweden	8 330	56	57	7 135	9 443	467 4	1 675	1 858	5 323	5 699	5 918	6 350	7 706	8 668
Scandinavia	**17.317**	**125**	**135**	**16.470**	**20.485**	**397.0**	**3.307**	**3.573**	**11.884**	**12.565**	**13.117**	**14.106**	**15.942**	**17.471**
Austria	7 551	35	18	2 062	1 222	240 3	819	831	1 157	1 170	1 707	1 789	1 189	1 169
Iceland	235	0	0	0	0	225 1	21	24	0	0	0	0	0	0
Malta	350	0	0	0	0	157 4	25e	25e	0	0	0	0	0	0
Portugal	10 088	95	8	720	1 020	106 7	506	488	451	425	583	595	952	1 042
Spain	38 249	197	30	3 113	1 592	160 1	2 807	2 778	1 450	1 383	2 684	2 754	1 360	1 412
Switzerland	6 437	29	5	1 050	325	360 7	1 003	1 053	496	540	889	918	292	284
Other W. Europe	**62.910**	**356**	**61**	**6.945**	**4.159**	**182.1**	**5.181**	**5.199**	**3.554**	**3.518**	**5.863**	**6.056**	**3.793**	**3.907**
Total W. Europe	**350.674**	**1.462**	**305**	**50.820**	**30.889**	**263.7**	**40.938**	**42.390**	**28.050**	**29.435**	**42.701**	**44.349**	**25.074**	**26.910**
Albania	2 750	4	4	10e	10e	10 4	13e	13e	8e	8e	8e	8e	8e	8e
Bulgaria	8 949	20		520	280	114 9	462	466	334	351	354	359	212	203
Czechoslovakia	15 000	49	24	1 331	1 031	167 5	1 182	1 182	976	984	1 249	1 258	960	977
German Dem Rep	16 702	21	19			178 4	1 355	1 352	801	803	1 261	1 244	678	674
Hungary	10 700	10	6			133 8	643	649	287	311	462	478	105	103
Poland	36 700	52	21	1 373	1 030	74 5	1 267	1 240	973	996	1 173	1 221	813	871
Romania	22 000	20	12	870e	970e	68 6	684e	685e	939e	959e	805e	806e	815e	845e
USSR	273 800	84	57	10 500	9 500	77 2	8 828	9 446e	6 770	7 233e	8 978	9 556e	7 444	6 913e
Yugoslavia	22 896	30	21	1 425	825	110 2	1 160	1 172	951	884	1 190	1 229	749	767
E. Europe	**409.497**	**290**	**164**	**16.029**	**13.646**	**87.3**	**15.594**	**16.205**	**12.039**	**12.529**	**15.480**	**16.159**	**11.784**	**12.361**
Total Europe	**760.171**	**1.752**	**469**	**66.649**	**44.535**	**168.7**	**56.532**	**58.595**	**40.089**	**41.974**	**58.181**	**60.508**	**36.858**	**39.271**
NORTH AMERICA														
Canada	24 900	107	34	15 397	23 418	415 3	4 292	4 691	11 331	12 579	12 408	13 353	17 007	19 221
United States	234 000	581	195*	64 242	50 986	588 6	57 808	63 216	44 993	48 068	53 965	58 849	44 755	47 661
North America	**258.900**	**688**	**229**	**79.639**	**74.404**	**571.9**	**62.100**	**67.907**	**56.324**	**60.647**	**66.373**	**72.202**	**61.762**	**66.882**
ASIA														
Afghanistan	16 000	0	0	0	0	0 2	1e	1e	0	0	0	0	0	0
Bangladesh	91 000	7	8	165	150	2 2	83	95e	97	97e	73	79e	87	87e
Bahrain	400	0	0	0	0	11 0	2e	2e	0	0	0	0	0	0
Bhutan	1 400	0	0	0	0	1 5	1e	1e	0	0	0	0	0	0
Brunei	300	0	0	0	0	14 8	2e	2e	0	0	0	0	0	0
Burma	33 700	4	2	–	–	2 6	40e	40e	17e	17e	10e	10e	17e	17e
China People's Rep	1 024 950	1 600e	–	7 280	6 190	15 0	6 222	6 931	4 917	5 456	5 890	6 613	4 439	4 725
Cyprus	700	0	0	0	0	119 7	46	38e	0	0	0	0	0	0
Hong Kong	5 200	3	0	30	0	262 8	620	620e	5	5	20	20e	0	0
India	683 000	222	303	2 165	56	4 9	1 520	1 517	900e	900e	1 250	1 337	850e	850e
Indonesia	150 000	34	15	676	–	9 3	629	626	352	167	332	377	153	167
Iran	40 000	17	8	330	260	25 1	550	454e	180	140e	139	104e	100	80e
Iraq	13 000	2	2	144	90	19 8	70	70e	50	50e	30	30e	30	30e
Israel	4 213	8	0	155	0	177 5	330	339	68	72	133	139	0	0
Japan	119 453	593	65	23 198	12 459	337 3	17 345	18 389	10 313	10 986	17 453	18 442	8 627	8 860
Jordan	3 000	1	2	12	–	8 8	11	12	0	0	15	12	–	–
Kampuchea	9 000	0	0	0	0	1 8	7	7e	0	0	0	0	0	0
Korea People's Rep	20 000	6	2	100	80	9 9	90	90	50	50	80	80	50	50
Korea Rep of	39 331	170	5	2 180	314	108 5	1 660	1 935	671	754	1 737	1 982	235	242
Kuwait	1 400	1	0	24	0	141 8	75	90	5	10	5	20	0	0
Laos	3 800	0	0	0	0	0 7	1	1e	0	0	0	0	0	0
Lebanon	3 300	3	0	20e	0	56 9	90	85e	10	10	10	5	0	0
Macao	300	0	0	0	0	80 9	11	11	0	0	0	0	0	0
Malaysia	11 427	13	–	–	–	59 5	318	335e	4	4e	50	60e		–
Mongolia	1 750	1	1	10	–	16 3	13	13e	5	5e	5	5e	5	5e
Nepal	14 700	2	1	5e	15e	2 0	13	13e	8	8e	3	3e	8	8e
Oman	1 000	0	0	0	0	11 0	5	5e	0	0	0	0	0	0
Pakistan	87 524	20	18	140	115	4 4	225	259	109	126	119	133	95	110
Philippines	52 000	20	8	515	303	18 1	366	427	162	210	233	292	127	145
Qatar	300	0	0	0	0	22 0	3	3e	0	0	0	0	0	0
Saudi Arabia	9 400	0	0	0	0	25 8	106	110e	0	0	0	0	0	0
Singapore	2 500	2	0	40e	0	211 6	248	240e	3	3e	15	15e	0	0
Sri Lanka	14 800	2	2	38	26	10 8	67	72e	28	28e	22	27e	21	21e
Syria	9 000	3	0	65	0	17 0	69	69	0	0	10	10e	0	0
Taiwan	18 775	157	2	1 960	400	202 8	1 487	1 704	354	416	1 557	1 720	293*	300*
Thailand	50 000	33	5	446	110	22 7	491	517	128	130e	351	360e	41	50e
Turkey	48 000	35	16	637	548	26 7	588	581e	371	238e	531	568e	350	180e
United Arab Emirates	1 000	0	0	0	0	13 2	6	6e	0	0	0	0	0	0
Vietnam	53 000	55e	50e	100e	90e	3 7	68e	88e	85e	95e	63e	83e	35e	40e
Yemen Arab Rep	5 500	0	0	0	0	0 9	2	2e	0	0	0	0	0	0
Yemen Dem Rep	2 000	0	0	0	0	2 2	2	2e	0	0	0	0	0	0
Asia	**2,646.123**	**3,014**	**515**	**40,435**	**21,206**	**28.0**	**33,483**	**35,802**	**18,892**	**19,977**	**30,136**	**32,526**	**15,563**	**15,967**

**Market pulp only*

e Estimate

Note The per capita figure is for consumption of paper and board in 1983 Some national editors have taken other factors into consideration such as inventory hence production plus imports less exports is not always the same amount as noted above

INDUSTRY AT A GLANCE

	Population (000)	Number of mills		CAPACITY (000 m tons)		Per capita (lb)	CONSUMPTION (000 m tons)				PRODUCTION (000 m tons)			
		P&B	Pulp	P&B	Pulp		P&B		Pulp		P&B		Pulp	
							1982	1983	1982	1983	1982	1983	1982	1983
AUSTRALASIA														
Australia	15 371	16	18	1.750	1.155	280.0	2.049	2.025	947	828	1 496	1 451	705	618
Fiji	700	0	0	0	0	31.5	10e	10e	0	0	0	0	0	0
New Zealand	3 190	6	6	797	1.312	324.1	488	419	615	611	702	669	1 040	1 073
Papua New Guinea	3 700	0	0	0	0	3.5	6e	6e	0	0	0	0	0	0
Samoa	200	0	0	0	0	11.0	1e	1e	0	0	0	0	0	0
Australasia	**23,161**	**22**	**24**	**2,547**	**2,467**	**232.1**	**2,554**	**2,461**	**1,562**	**1,439**	**2,198**	**2,120**	**1,745**	**1,691**
LATIN AMERICA														
Argentina	29 000	91	18	1.020	670	70.5	918	929	504	637	838	883	390	618
Bahamas	210	0	0	0	0	10.6	1	1e	0	0	0	0	0	0
Barbados	280	0	0	0	0	55.1	7	7e	0	0	0	0	0	0
Belize	150	0	0	0	0	29.3	3	2e	0	0	0	0	0	0
Bolivia	5 600	2	0	-	0	39.0e	99e	99e	48e	48e	59e	59e	26e	26e
Brazil	126 480	160	48	-	-	57.1	3 312	3 271	2 136	1 919	3 314	3 420	2 898	2 917
Chile	11 682	18	7	433	851	50.5	222	267	190	276	262	325	667	796
Colombia	28 000	26	6	530	250	35.5	460	451e	233	235e	366	365e	194	189e
Costa Rica	2 435	2	1	18	25	112.2	124	124	13	16	13	13	7	10
Cuba	10 000	9	3	150	60	51.1	232	232e	80	80e	73	73e	32	32e
Dominican Rep	5 551	2	0	45e	0	25.8	65	65e	4	4e	9	9e	0	0
Ecuador	8 500	9	5	62	32	25.6	99	99	48	48	59	59	26	26
El Salvador	5 500	3	0	40	0	20.9	52	52e	3	5	22	23	0	0
Guatemala	7 500	4	0	50	0	28.0	88	95e	5	10e	43	40e	0	0
Guyana	900	0	0	0	0	17.2	7	7e	0	0	0	0	0	0
Haiti	5 800	0	0	0	0	2.2	6	6e	0	0	0	0	0	0
Honduras	4 000	0	0	0	0	38.6	65	70e	0	0	0	0	0	0
Jamaica	2 226	1	0	18e	0	22.7	22	23	0	0	9	8	0	0
Mexico	77 000	66	23	2 967	1 078	63.3	2 268	2 208	876	913	1 987	2 062	748	759
Neth. Antilles	247	0	0	0	0	26.7	3	3e	0	0	0	0	0	0
Nicaragua	2 000	0	0	0	0	22.0	25	20e	0	0	0	0	0	0
Panama	2 100	3	0	20	0	84.0	80	80	0	0	21	23	0	0
Paraguay	3 117	3	0	0	0	18.3	26	26e	15	15	13	13	15	15
Peru	19 000	15	4	427	311	20.5	197	176	110	81	145	131	75	60
Surinam	355	0	0	0	0	93.3	15	15e	0	0	0	0	0	0
Trinidad/Tobago	1 200	0	0	0	0	56.9	31	31e	0	0	0	0	0	0
Uruguay	2 900	12	5	60	28	37.3	47	49	28	32	43	47	21	28
Venezuela	16 800	12	3	650	160	102.3	779	779	233	233	539	539	63	63
Latin America	**378,533**	**438**	**123**	**6,490**	**3,465**	**53.6**	**9,253**	**9,187**	**4,526**	**4,552**	**7,815**	**8,092**	**5,162**	**5,539**
AFRICA														
Algeria	20 000	6	3	34	24	15.0	133	135	92	91	87	90	31	31
Angola	7 200	2	1	30e	45e	8.6	28e	28e	25e	25e	15e	15e	35e	35e
Benin	3 670	0	0	0	0	1.8	3e	3e	0	0	0	0	0	0
Botswana	850	0	0	0	0	2.6	1e	1e	0	0	0	0	0	0
Burundi	4 590	0	0	0	0	2.0	4e	4e	0	0	0	0	0	0
Cameroon	8 600	0	1	0	120	6.4	25e	25e	0	0	0	0	90e	90e
Central African Rep	2 340	0	0	0	0	0.9	1e	1e	0	0	0	0	0	0
Chad	4 590	0	0	0	0	0.9	2e	2e	0	0	0	0	0	0
Congo	1 580	0	0	0	0	1.3	1e	1e	0	0	0	0	0	0
Egypt	45 000	15	3	170	60	14.3	270	292	75	78	133	136	46	47
Ethiopia	33 000	2	0	8	0	1.1	15e	15e	5	5e	5	5e	0	0
Gabon	610	0	0	0	0	7.3	2e	2e	0	0	0	0	0	0
Gambia	610	0	0	0	0	7.3	2e	2e	0	0	0	0	0	0
Ghana	15 000	0	0	0	0	0.4	3e	3e	0	0	0	0	0	0
Guinea	5 410	0	0	0	0	1.5	4e	4e	0	0	0	0	0	0
Ivory Coast	8 160	0	0	0	0	9.5	35	35e	0	0	0	0	0	0
Kenya	17 000	4	2	80	60	8.4	55	65e	53	55e	60	67e	53	52e
Lesotho	1 380	0	0	0	0	1.5	1e	1e	0	0	0	0	0	0
Liberia	1 910	0	0	0	0	1.1	1e	1e	0	0	0	0	0	0
Libya	3 000	2	0	10	0	15.4	21e	21e	6	6e	6	6e	0	0
Madagascar	9 500	1	2	28	11	3.7	14	16	10	11	12	14	6	7
Malawi	6 120	0	0	0	0	4.4	12e	12e	0	0	0	0	0	0
Mali	7 040	0	0	0	0	0.2	1e	1e	0	0	0	0	0	0
Mauritania	1 680	0	0	0	0	5.3	4e	4e	0	0	0	0	0	0
Mauritius	1 020	0	0	0	0	15.2	7e	7e	0	0	0	0	0	0
Morocco	21 500	8	1	120	100	19.8	174	182	41	55	104	108	69	86
Mozambique	10 500	2	0	10	0	4.6	23e	23e	3	3e	3	3e	0	0
Niger	5 460	0	0	0	0	0.4	1e	1e	0	0	0	0	0	0
Nigeria	85 000	3	3	14	-	4.4	110	252	0	35	0	12	[illegible]	24
Rwanda	5 100	0	0	0	0	0.9	2e	2e	0	0	0	0	0	0
Senegal	5 770	0	0	0	0	6.4	17e	17e	0	0	0	0	0	0
Sierra Leone	3 570	0	0	0	0	1.3	2e	2e	0	0	0	0	0	0
Somalia	3 770	0	0	0	0	1.1	2e	2e	0	0	0	0	0	0
South Africa	24 000	16	10	1 460	1 190	118.6	1 325	1 292	989e	985e	1 295	1 255	1 165e	1 165e
Sudan	21 595	4	0	10	0	4.4	13	20e	0	0	3	10	0	0
Swaziland	700	0	1	0	180	3.1	1	1	1	-	0	0	170	175
Tanzania	17 750	1	0	4	0	3.5	28	28e	3	3e	3	3e	0	0
Togo	2 650	0	0	0	0	5.1	6e	6e	0	0	0	0	0	0
Tunisia	6 500	5	1	35	25	27.6	77	81	9	10	29	33	18	20
Uganda	13 500	1	0	5	0	1.3	8	8e	3	3	3e	3e	0	0
Upper Volta	7 040	0	0	0	0	0.2	1e	1e	0	0	0	0	0	0
Zaire	28 350	1	0	3	0	0.7	9e	9e	1e	1e	1	1	0	0
Zambia	6 250	1	2	16	14e	11.2	32e	32e	12	15	12	12e	7e	10e
Zimbabwe	7 500	3	2	75	35e	23.6	80e	80e	55e	55e	55e	55e	30e	30e
Africa	**486,365**	**77**	**32**	**2,112**	**1,864**	**12.3**	**2,556**	**2,720**	**1,383**	**1,431**	**1,826**	**1,828**	**1,720**	**1,772**
WORLD TOTAL	**4,553,253**	**5,981**	**1,392**	**198,072**	**147,941**	**85.5**	**166,478**	**176,672**	**122,776**	**130,010**	**166,529**	**177,276**	**122,810**	**131,122**

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REVIEW OF TOP 26 NATIONS IN PULP/PAPER PRODUCTION

Abridged data on production and export/import trade are given for countries included in the Top 20 tables for paper and board production and for pulp production

AUSTRALIA

Population: 15,370,800. Per capita consumption of paper and board: 127 kg/281 lb. Paper and board mills: 16. Pulp mills: 18 (sulfate: 2; sulfite: 1; soda: 2; semichemical: 4; mechanical: 8; nonwood: 1)

Paper/board capacity: 1,750,000e tons **Pulp capacity:** 1,155,000e tons

(000 metric tons)

	Production		Imports		Exports	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Newsprint and other printing paper	548	569	432	346	14	—
Other paper and board	948	882	196	228	61	—
Total	**1,496**	**1,451**	**628**	**574**	**75**	**—**
Chemical woodpulp	479	—	241	212	—	6
Other pulps	226	—	1	4	—	—
Total	**705**	**618**	**242**	**216**	**—**	**6**

AUSTRIA

Population: 7,551,000. Per capita consumption of paper and board: 109 kg/241 lb. Paper and board mills: 35. Pulp mills: 18 (sulfate: 2; sulfite: 8; semichemical: 1; mechanical: 7)

Paper/board capacity: 2,062,000 tons **Pulp capacity:** 1,222,000 tons
Operating rate 1983: 87% **Operating rate 1983:** 85%

(000 metric tons)

	Production		Imports		Exports	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	961	1,014	127	158	628	720
Board/wrapping paper	746	775	84	91	471	487
Total	**1.707**	**1,789**	**211**	**249**	**1,099**	**1,207**
Chemical woodpulp	853	850	183	220	221	224
Other pulps	336	319	18	17	12	12
Total	**1,189**	**1,169**	**201**	**237**	**233**	**236**

BRAZIL

Population: 126,500,000. Per capita consumption of paper and board: 26 kg/57 lb. Paper and board mills: 160. Pulp mills: 48

Paper/board capacity: n.a. **Pulp capacity:** n.a.

(000 metric tons)

	Production		Imports		Exports	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	2,013	2,055	249	252	197	262
Board	1,301	1,365	—	—	54	139
Total	**3,314**	**3,420**	**249**	**252**	**251**	**401**
Chemical woodpulp	2,898	2,917	12	8	775	1,011
Other pulps	—	—	1	5	—	—
Total	**2,898**	**2,917**	**13**	**13**	**775**	**1,011**

CANADA

Population: 24,900,000. Per capita consumption of paper and board: 188 kg/414 lb. Paper and board mills: 107. Pulp mills: 34.

Paper/board capacity: 15,397,000 tons **Pulp capacity:** 23,418,000 tons
Operating rate 1983: 85% **Operating rate 1983:** 84%

(000 metric tons)

	Production		Imports		Exports	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	10,425	11,069	220	291	8,101	8,602
Board	1,983	2,284	149	167	384	518
Total	**12,408**	**13,353**	**369**	**458**	**8,485**	**9,120**
Chemical woodpulp	9,956	11,212	87	97	5,372	6,352
Other pulps	7,051	8,009	59	56	450	443
Total	**17,007**	**19,221**	**146**	**153**	**5,822**	**6,795**

CHINA, PEOPLE'S REP. OF

Population: 1,021,950,000. Per capita consumption of paper and board: 6.8 kg/15 lb. Paper and board mills: 1,600e

Paper/board capacity: 7,280,000 tons **Pulp capacity:** 6,190,000 tons

(000 metric tons)

	Production		Imports		Exports	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	3,233	3,570	149	n.a.	106	n.a.
Packaging paper/board	2,657	3,043	381	n.a.	92	n.a.
Total	**5,890**	**6,613**	**530**	**518**	**198**	**n.a.**
Chemical woodpulp	760	775	396	n.a.	—	n.a.
Mechanical pulp	335	342	—	n.a.	—	n.a.
Reed, bamboo, other pulps	3,344	3,608	82	n.a.	—	n.a.
Total	**4,439**	**4,725**	**478**	**731**	**—**	**n.a.**

CZECHOSLOVAKIA

Population: 15,000,000. Per capita consumption of paper and board: 76 kg/168 lb. Paper and board mills: 49. Pulp mills: 24 (sulfate: 5; sulfite: 7; semichemical: 1; mechanical: 10; nonwood: 1)

Paper/board capacity: 1,311,000 tons **Pulp capacity:** 1,031,000 tons
Operating rate 1983: 96% **Operating rate 1983:** 95%

(000 metric tons)

	Production		Imports		Exports	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	709	722	41	41	92	88
Board	538	536	84	67	100	86
Total	**1,247**	**1,258**	**125**	**108**	**192**	**174**
Chemical woodpulp	727	771	56	61	60	86
Other pulps	232	206	29	41	3	3
Total	**959**	**977**	**85**	**102**	**63**	**89**

FINLAND

Population: 4,857,000. Per capita consumption of paper and board: 168 kg/370 lb. Paper and board mills: 46. Pulp mills: 51 (sulfate: 18; sulfite: 8; semichemical: 3; mechanical: 22)

Paper/board capacity: 7,550,000 tons **Pulp capacity:** 8,872,000 tons

(000 metric tons)

	Production		Imports		Exports	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	4,444	4,825	14	14	3,664	4,042
Board	1,451	1,563	28	37	1,168	1,215
Total	**5,895**	**6,388**	**42**	**51**	**4,832**	**5,257**
Chemical woodpulp	4,103	4,379	10	13	1,278	1,404
Other pulps	2,611	2,784	45	19	179	168
Total	**6,714**	**7,163**	**55**	**32**	**1,457**	**1,572**

FRANCE

Population: 54,000,000. Per capita consumption of paper and board: 121 kg/267 lb. Paper and board mills: 165. Pulp mills: 26 (sulfate: 7; sulfite: 4; semichemical: 6; mechanical: 9)

Paper/board capacity: 5,500,000 tons **Pulp capacity:** 2,250,000 tons

(000 metric tons)

	Production		Imports		Exports	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	3,077	3,104	1,425	1,483	821	832
Board	2,050	2,157	887	958	300	360
Total	**5,127**	**5,261**	**2,312**	**2,441**	**1,121**	**1,192**
Chemical woodpulp	1,342	1,455	1,461	1,502	167	213
Other pulps	423	407	58	65	2	4
Total	**1,765**	**1,862**	**1,519**	**1,567**	**169**	**217**

exporter.

Canada is currently fighting an EEC attempt to slash the annual non-EFTA nations' duty-free newsprint quota from 1.5 million tons to only 500,000 tons. At mid-1984, the problem still had not been resolved.

The outlook for 1984 was quite positive, and it appears certain that new record levels will be set in the U.S. in almost every category. Production in first-half 1984 at U.S. paper and board mills was a record 31.75 million tons, 9% above the level of the 1983 period, which was also a record. Similar strong rates have been registered for both pulp and wastepaper demand.

Profitability, which also recovered strongly during the fourth quarter of 1983, was expected to benefit from the price increases achieved for most products since the start of 1984. The industry's capital ex-

TOP 26 PRODUCING NATIONS *(Continued)*

GERMANY, FED. REP.

Population: 61,421,000. Per capita consumption of paper and board: 160 kg/353 lb. Paper and board mills: 206. Pulp mills: 37 (sulfite: 10; semichemical: 1; mechanical: 26)

Paper/board capacity: 9,091,000 tons **Pulp capacity:** 2,125,000 tons
Operating rate 1983: 91% **Operating rate 1983:** 98%

(000 metric tons)

	Production		Imports		Exports	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	5,126	5,479	2,534	2,718	1,401	1,604
Board	2,657	2,793	1,138	1,221	681	784
Total	**7,783**	**8,272**	**3,672**	**3,939**	**2,082**	**2,388**
Chemical woodpulp	792	800	2,345	2,703	96	114
Other pulps	1,212	1,281	64	73	6	—
Total	**2,004**	**2,081**	**2,409**	**2,776**	**102**	**114**

ITALY

Population: 56,800,000. Per capita consumption of paper and board: 86 kg/190 lb. Paper and board mills: 430. Pulp mills: 30 (sulfite: 2; semichemical: 5; mechanical: 16; nonwood: 7)

Paper/board capacity: 5,350,000 tons **Pulp capacity:** 1,050,000 tons
Operating rate 1983: 80% **Operating rate 1983:** 75%

(000 metric tons)

	Production		Imports		Exports	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	2,574	2,468	672	834	619	620
Board	1,999	1,791	429	539	170	158
Total	**4,573**	**4,259**	**1,101**	**1,373**	**789**	**778**
Chemical woodpulp	188	213	1,268	1,276	19	40
Other pulps	628	574	90	103	—	1
Total	**816**	**787**	**1,358**	**1,379**	**19**	**41**

JAPAN

Population: 119,483,000. Per capita consumption of paper and board: 153 kg/338 lb. Paper and board mills: 593. Pulp mills: 65 (sulfate: 37; sulfite: 3; semichemical: 11; mechanical: 18; nonwood: 3)

Paper/board capacity: 23,198,000 tons **Pulp capacity:** 12,459,000 tons
Operating rate 1983: 80% **Operating rate 1983:** 71%

(000 metric tons)

	Production		Imports		Exports	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	10,351	10,932	351	402	411	365
Board	7,099	7,510	278	280	329	373
Total	**17,450**	**18,442**	**632**	**682**	**740**	**738**
Chemical woodpulp	6,508	6,738	1,274	1,516	66	43
Other pulps	2,118	4,239	479	657	2	2
Total	**8,626**	**8,859**	**1,753**	**2,173**	**68**	**45**

KOREA, REP. OF

Population: 39,331,000. Per capita consumption of paper and board: 49 kg/108 lb. Paper and board mills: 170e. Pulp mills: 5 (sulfate: 1; mechanical: 4)

Paper/board capacity: 2,180,000e tons **Pulp capacity:** 314,000 tons
Operating rate 1983: 89% **Operating rate 1983:** 79%

(000 metric tons)

	Production		Imports		Exports	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	893	1,035	25	36	70	52
Board	844	947	12	16	45	46
Total	**1,737**	**1,982**	**37**	**52**	**115**	**98**
Chemical woodpulp	108	116	377	453	—	—
Other pulps	127	126	59	59	—	—
Total	**235**	**242**	**436**	**512**	**—**	**—**

MEXICO

Population: 77,000,000. Per capita consumption of paper and board: 29 kg/64 lb. Paper and board mills: 66. Pulp mills: 23 (sulfate: 10; sulfite: 1; mechanical: 1; nonwood: 10)

Paper/board capacity: 2,967,000 tons **Pulp capacity:** 1,078,000 tons
Operating rate 1983: 69% **Operating rate 1983:** 70%

(000 metric tons)

	Production		Imports		Exports	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	1,123	1,166	211	87	—	—
Board	864	895	70	59	—	—
Total	**1,987**	**2,061**	**281**	**146**	**—**	**—**
Chemical woodpulp	422	414	110	145	—	—
Other pulps	326	345	18	9	—	—
Total	**748**	**759**	**128**	**154**	**—**	**—**

NETHERLANDS

Population: 14,360,000. Per capita consumption of paper and board: 158 kg/348 lb. Paper and board mills: 35. Pulp mills: 3 (mechanical: 2; nonwood: 1)

Paper/board capacity: 1,878,000 tons **Pulp capacity:** 152,000 tons
Operating rate 1983: 93% **Operating rate 1983:** 99%

(000 metric tons)

	Production		Imports		Exports	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	801	880	933	1,010	448	529
Board	832	857	463	504	404	466
Total	**1,633**	**1,737**	**1,396**	**1,514**	**852**	**995**
Chemical woodpulp	—	—	470	521	7	3
Other pulps	136	147	30	28	4	1
Total	**136**	**147**	**500**	**549**	**11**	**4**

penditures have also continued to climb and are estimated at $7.0 billion for 1984.

In Canada, newsprint shipments are expected to rise another 9% in 1984 to a new record, with the mills operating at 93% of capacity. In the market pulp sector, considerable tonnage was lost by the long lockout in British Columbia mills early in the year, but CPPA expected shipments to rise 7% to a reach record 7.4 million tons.

ASIA/ AUSTRALASIA

In Asia, production of both pulp and paper in 1983 were at substantially higher levels than the previous year. The rise in paper and board output was the biggest for at least the last seven years—up nearly 8% at 32.5 million tons. Pulp production went up less, 2.6%, to just under 16 million tons.

In contrast, 1983 paper and board output in Australasia (effectively Australia and New Zealand) was lower than in 1982, making it the only region to see production decline in 1983. It dropped by 3.7% to 2.12 million tons. Output has stayed in the 2.0- to 2.2-million-ton region since 1979. Apparent consumption was down 3.6% at 2.46 million tons, and pulp production fell by 3%, to 1.69 million tons.

Of the big five in Asia, **Japan** reached a new record level for paper and board output of 18.4 million tons, up 5.7% from 1982. Japan remains by far the major producer in Asia; as usual, it produced over 50% of the region's output.

The improvement in the Japanese economy, like that of some other nations, was fueled by exports to the U.S. in first-half 1983, followed by higher domestic demand in the second. Japan raised newsprint and linerboard imports and, following U.S. and EEC pressure, is reducing its import duty on paper products on a shorter time-scale. Domestic industry continues to rationalize with company mergers and agreements to cut overall paper and board capacity. However, there are still several major capital investments going through that will improve product quality and also efficiency.

Rep. of Korea and **Taiwan** both had improved market conditions in 1983 and, like Japan, were optimistic about 1984. Rep. of Korea recovered completely with paper output up 14% to just under two million tons. Newsprint markets remained the one weak area (as was the case in Japan and some other Asian countries). In Taiwan, 1983 output was also up, by 10.5% at 1.72 million tons, despite lost output from the temporary closure of two major companies.

Paper and board output in **India** increased by 7% to 1.34 million tons. Two new newsprint mills started up during the year and more are under construction. India also saw a sharp increase in the number of small mills (from 2 to 30 tpd) using imported second-hand machines. The bigger mills were hit by power failures and shortages of raw materials and spare parts. Similar problems affect the smaller producers in neighboring Pakistan and Bangladesh.

People's Rep. of China had another major rise in paper and board production in 1983, up 12.3% to 6.61 million tons, while imports dropped 2% to 518,000 tons. A machine modernization program is widespread, as shown by new rebuild agreements with major foreign suppliers and by the 420,000-tpy rise in paper and board production capacity in 1983.

As for new mill projects, **Malaysia** is now set to go ahead with two big new integrated printing/writing mills, and there are tentative plans for a new mill in **Thailand.** In **Indonesia,** a major kraft paper and board project is now in doubt following the withdrawal of Georgia-Pacific Corp. Government control of paper dumping helped, mills in the **Philippines** to increase output, but the difficulty of importing raw materials and the poor profitability of industry make the 1984 outlook uncertain.

Australasia output falls. Paper and board output in 1983 for both Australia and New Zealand fell below 1982 levels. While both enjoyed the beginnings of recovery by end-1983, it came too late to boost output, and industry profitability was down, particularly in Australia. An 8% drop in output of packaging and industrial grades—one result of a bad drought—was largely responsible for Australia's 3% drop to 1.45 million tons.

The pulp and paper industry in New Zealand, where nearly 50% of output is exported, was hit in early 1983 by weak international markets. Pulp output ended the year marginally up at 1.07 million tons, while paper and board production was down 4.7% at 669,000 tons. But there was a marked improvement in early 1984 and some companies expected record profits.

LATIN AMERICA

The economic upswing in North America and Europe, beginning in the second half of 1983, brought some relief to the pulp and paper industry in Latin America. One major problem that did not go away, however, was the continent's massive foreign debt, estimated to be $160 billion. The 1984 interest payments on existing loans alone were estimated at $22.5 billion.

With inflation rates in double, and sometimes treble, figures (Argentina's was 500% in 1983-84), the trend in the pulp and paper industry was toward greater self-sufficiency, especially in pulp and newsprint, to ease the crippling import bill for these commodities.

OUTPUT UP IN 1983

Total Latin American paper and board output rose 3.5% in 1983 to just over eight million tons. In line with the continent's overall plan of cutting imports and boosting exports, paper and board imports fell 7.9% to 1.67 million tons, while exports rose a massive 48.8% (mainly from Brazil and Chile), to just under 600,000 tons. Much of the increase was traded internally among Latin American countries.

Total pulp production in Latin America last year rose 7.7% to 5.538 million tons. Pulp imports fell 5.4% to 577,000 tons, and exports were up 25.5% to 1.57 million tons. In **Argentina**, the new Alto Paraná mill helped raise pulp exports by 38,000 tons in its first year. The mill expects to export 40%, or almost 70,000 tpy, of

TOP 26 PRODUCING NATIONS *(Continued)*

NEW ZEALAND

Population: 3,190,000. Per capita consumption of paper and board: 147 kg/324 lb. Paper and board mills: 6. Pulp mills: 6 (sulfate: 2; semichemical: 2; mechanical: 5)

Paper/board capacity: 797,091 tons
Operating rate 1983: 84%
Pulp capacity: 1,312,170 tons
Operating rate 1983: 82%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	476	410	47	37	222	228
Board	226	259	—	—	38	59
Total	**702**	**669**	**47**	**37**	**260**	**287**
Chemical woodpulp	557	604	14	7	227	219
Other pulps	483	469	2	1	214	251
Total	**1,040**	**1,073**	**16**	**8**	**441**	**470**

NORWAY

Population: 4,130,000. Per capita consumption of paper and board: 130 kg/287 lb. Paper and board mills: 23. Pulp mills: 27 (sulfate: 2; sulfite: 4; semichemical: 2; mechanical: 19)

Paper/board capacity: 1,785,000 tons
Operating rate 1983: 77%
Pulp capacity: 2,170,000 tons
Operating rate 1983: 75%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	1,170	1,234	110	120	898	961
Board	134	134	97	96	90	96
Total	**1,304**	**1,368**	**207**	**216**	**988**	**1,057**
Chemical woodpulp	642	715	219	131	333	378
Other pulps	992	1,060	6	11	271	295
Total	**1,522**	**1,540**	**222**	**138**	**495**	**535**

POLAND

Population: 36,700,000. Per capita consumption of paper and board: 34 kg/75 lb. Paper and board mills: 52. Pulp mills: 21 (sulfate: 6; sulfite: 2; semichemical: 2; mechanical: 8; nonwood: 3)

Paper/board capacity: 1,373,000 tons
Pulp capacity: 1,030,000 tons

(000 metric tons)

	Production		**Imports**		**Exports**	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	765	813	70	73	16	29
Board	408	408	56	27	16	52
Total	**1,173**	**1,221**	**126**	**100**	**32**	**81**
Chemical woodpulp	618	678	130	112	4	32
Other pulps	195	193	34	45	—	—
Total	**813**	**871**	**164**	**157**	**4**	**32**

PORTUGAL

Population: 10,088,200. Per capita consumption of paper and board: 48 kg/106 lb. Paper and board mills: 95. Pulp mills: 8 (sulfate: 5; sulfite: 2; soda: 1)

Paper/board capacity: 720,000 tons
Operating rate 1983: 83%
Pulp capacity: 1,020,000 tons
Operating rate 1983: 102%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	370	[illegible]	47	50	21	41
Board	218	187	34	23	137	139
Total	**558**	**595**	**81**	**73**	**158**	**180**
Chemical woodpulp	909	1,010	13	18	521	641
Other pulps	43	32	7	6	—	—
Total	**952**	**1,042**	**20**	**24**	**521**	**641**

ROMANIA

Population: 22,000,000. Per capita consumption of paper and board: 31 kg/68 lb. Paper and board mills: 20. Pulp mills: 12 (sulfate: 7; sulfite: 3; semichemical: 1; mechanical: 1; nonwood: 4)

Paper/board capacity: 870,000e tons
Pulp capacity: 970,000e tons

(000 metric tons)

	Production		**Imports**		**Exports**	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	255	256	n.a.	n.a.	n.a.	n.a.
Board	550	550	n.a.	n.a.	n.a.	n.a.
Total	**805**	**806**	**46**	**46**	**167**	**167**
Chemical woodpulp	645	675	n.a.	n.a.	n.a.	n.a.
Other pulps	170	170	n.a.	n.a.	n.a.	n.a.
Total	**815**	**845**	**134**	**134**	**10**	**20**

SOUTH AFRICA

Population: 24,000,000. Per capita consumption of paper and board: 54 kg/119 lb. Paper and board mills: 16. Pulp mills: 10 (sulfate: 2; sulfite: 1; soda: 1; semichemical: 2; mechanical: 2; nonwood: 2)

Paper/board capacity: 1,460,000 tons
Pulp capacity: 1,190,000 tons

(000 metric tons)

	Production		**Imports**		**Exports**	
	1982	**1983**	**1982**	**1983**	**1982**	**1983**
Paper	747	690	158	169	171	147
Board	548	565	79	71	36	54
Total	**1,295**	**1,255**	**237**	**240**	**207**	**201**
Chemical woodpulp	460	460	216	220	30	40
Other pulps	705	705	1	—	363	360
Total	**1,165**	**1,165**	**217**	**220**	**393**	**400**

its output at full capacity in 1984-85.

Pulp exports from **Chile** rose 9% to 520,000 tons, while **Brazil's** exports were up 30% at 1.011 million tons, breaking the million-ton barrier for the first time. Of Brazil's market pulp, 19% went to Japan in 1983, followed by 17% to the U.S. and 13% to Fed. Rep. Germany.

A number of pulp and paper projects were completed in 1983. Papel del Tucuman started up its 105,000-tpy bagasse-based newsprint mill at San Miguel, **Argentina**. In **Mexico**, San Cristóbal started up a new 50,000-tpy tissue machine at its Ecatepec mill.

Several major projects are scheduled for startup in Latin America in 1984. They include: Celulosa Argentina's 140,000-tpy kraft paper and corrugating medium mill and an adjacent 170,000-tpy unbleached

TOP 26 PRODUCING NATIONS *(Continued)*

SPAIN

Population: 38,249,000. Per capita consumption of paper and board: 73 kg/161 lb. Paper and board mills: 197. Pulp mills: 30 (sulfate: 13; sulfite: 1; semichemical: 1; mechanical: 10; nonwood: 5)

Paper/board capacity: 3,113,000* tons **Pulp capacity:** 1,592,000 tons
Operating rate 1983: 85% **Operating rate 1983:** 86%

(000 metric tons)

	Production		Imports		Exports	
	1982	1983	1982	1983	1982	1983
Paper	1,429	1,494	342	295	197	200
Board	1,254	1,260	119	117	140	188
Total	**2,683**	**2,754**	**461**	**412**	**337**	**388**
Chemical woodpulp	1,010	1,057	259	257	151	264
Other pulps (includes semichemical)	350	355	1	4	18	26
Total	**1,360**	**1,412**	**260**	**261**	**169**	**290**

* Calculated on working 330 days/year.

SWEDEN

Population: 8,330,000. Per capita consumption of paper and board: 212 kg/467 lb. Paper and board mills: 56, Pulp mills: 57 (sulfate: 25, sulfite: 9; semichemical: 2, mechanical: 21)

Paper/board capacity: 7,135,000 tons **Pulp capacity:** 9,443,000 tons
Operating rate 1983: 89% **Operating rate 1983:** 92%

(000 metric tons)

	Production		Imports		Exports	
	1982	1983	1982	1983	1982	1983
Paper	3,561	3,793	119	147	2,545	2,728
Board	2,357	2,557	65	67	1,882	1,978
Total	**5,918**	**6,350**	**184**	**214**	**4,427**	**4,706**
Chemical woodpulp	5,867	6,628	74	85	2,107	2,644
Other pulps	1,839	2,040	18	25	368	435
Total	**7,706**	**8,668**	**92**	**110**	**2,475**	**3,079**

TAIWAN

Population: 18,775,000. Per capita consumption of paper and board: 92 kg/204 lb. Paper and board mills: 175. Market pulp mills: 2 (sulfate: 1; nonwood: 1)

Paper/board capacity: 1,960,000 tons **Pulp capacity:** 400,000 tons
Operating rate 1983: 88% **Operating rate 1983:** 75%

(000 metric tons)

	Production		Imports		Exports	
	1982	1983	1982	1983	1982	1983
Paper	514	537	85	94	41	27
Board	1,042	1,183	13	13	127	96
Total	**1,556**	**1,720**	**98**	**107**	**168**	**123**
Chemical woodpulp	207	216	128	173	59	58
Other pulps	86	84	4	7	13	6
Total	**293**	**300**	**132**	**180**	**72**	**64**

U.S.S.R.

Population: 273,800,000. Per capita consumption of paper and board: 35 kg/77 lb. Paper and board mills: 84. Pulp mills: 57.

Paper/board capacity: 10,500,000 tons **Pulp capacity:** 9,500,000 tons

(000 metric tons)

	Production		Imports		Exports	
	1982	1983	1982	1983	1982	1983
Paper	5,439	5,667	690	740	730	731
Board	3,539	3,889	270	270	380	380
Total	**8,978**	**9,556**	**960**	**1,010**	**1,110**	**1,111**
Chemical woodpulp	5,881	6,251	271	271	955	955
Other pulps	1,563	1,662	—	—	—	—
Total	**7,444**	**7,913**	**271**	**271**	**955**	**955**

UNITED KINGDOM

Population: 55,950,000. Per capita consumption of paper and board: 126 kg/278 lb. Paper and board mills: 102. Pulp mills: 3 (semichemical: 2, mechanical: 1)

Paper/board capacity: 3,497,000 tons **Pulp capacity:** 196,000 tons
Operating rate 1983: 92% **Operating rate 1983:** 88%

(000 metric tons)

	Production		Imports		Exports	
	1982	1983	1982	1983	1982	1983
Paper	1,503	1,464	2,590	2,728	162	179
Board/other paper	1,695	1,745	1,361	1,557	237	245
Total	**3,198**	**3,209**	**3,951**	**4,285**	**399**	**424**
Chemical woodpulp	80	—	1,219	1,339	—	1
Other pulps	61	—	131	144	2	—
Total	**141**	**173**	**1,350**	**1,483**	**2**	**1**

UNITED STATES

Population: 234,000,000. Per capita consumption of paper and board: 267 kg/589 lb. Paper and board mills: 581 (1982). Pulp mills: 195 (sulfate: 120; sulfite: 20; semichemical: 41; mechanical: 47)

Paper/board capacity: 64,242,000* tons **Pulp capacity:** 50,986,000* tons
Operating rate 1983: 92% **Operating rate 1983:** 94%

(000 metric tons)

	Production		Imports		Exports	
	1982	1983	1982	1983	1982	1983
Paper	27,599	29,863	7,033	7,787	781	721
Board	26,366	28,986	105	152	2,514	2,851
Total	**53,965**	**58,849**	**7,138**	**7,939**	**3,295**	**3,572**
Chemical woodpulp	40,161	43,064	3,186	3,546	3,075	3,300
Other pulps	5,585	5,741	300	341	579	593
Total	**44,755**	**47,661**	**3,317**	**3,713**	**3,080**	**3,306**

* Capacity data exclude 1,141,000 tons of construction paper capacity and 1,354,000 tons of woodpulp for construction paper and board.

kraft pulp mill in **Argentina**; Pisa's 110,000-tpy newsprint machine and 100,000-tpy TMP pulp line, as well as Suzano's 140,000-tpy folding boxboard machine, both projects in **Brazil**; Papeles Sudaméricana's integrated 100,000-tpy packaging paper mill in **Chile**; Papelcol's 80,000-tpy integrated printing and writing paper mill in **Colombia**; and Celulosa de Guatemala's El Rancho pulp mill in **Guatemala**, scheduled to make 100,000 tpy of bleached and semibleached kraft pulp beginning at the end of 1984.

Although some large-scale pulp and paper projects were announced in various countries for late-1980s startup, the continuing debt crises were almost certain to cause postponements, according to observers.

AFRICA

For the third year in a row, African paper and board production stayed at virtually the same level. It totaled 1.83 million tons in 1983, just 2,000 tons higher than in 1982 and marginally below the 1981 total of 1.84 million tons.

The trend in African production shows steady growth through the late 1970s from 1.42 million tons in 1977, followed by almost zero growth in the early 1980s. But another growth period, probably the biggest in the continent's history, is about to begin as the major pulp and paper expansions in South Africa start running.

Paper and board output in **South Africa**, totaling over twice as much as the rest of African production put together, usually determines whether the continent has a good or bad year. However, in 1983 it was the output of the other nations that was responsible for the continent's total increase (though small) over 1982, because production in South Africa itself dropped 3% to 1.26 million tons.

A 35% drop in newsprint production was the main reason for the decline. However, paper stocks at South African mills also dropped over the year, by about 22% to 100,000 tons, and newsprint stocks dropped most of all, by about 50,000 tons to 30,000 tons by end-1983. A strong U.S. dollar, low gold price and a very severe drought all affected the South African economy with a consequent effect on paper and board demand. Alleged dumping of paper from the U.S. and weak international pulp and paper prices also took their toll.

But the South African capacity, and thus total African capacity, is going through its biggest growth period ever. The new pulp, newsprint and, particularly, linerboard production lines from Sappi's Ngodwana and Mondi's Richards Bay mills should be running by end-1985. The increase in output should become fully effective in 1987, provided of course that ready buyers (mainly in Europe and the Far East) for the increased export tonnage can be found.

Other expansion projects in Africa are also making progress, although realistic startup dates are difficult to determine. However, several were nearing completion.

In **Nigeria**, there is at last some hope that money may be provided by the new government to start up two of the three new mills. These have been built—and one even had a short trial run on one machine in 1983—but they lack funds for power and raw materials for startup.

In **Egypt**, two extensive mill modernizations are now under way, and tenders are being sought for a proposed greenfield integrated bagasse/printing and writing grade mill. The Southern Paper Mills' project at Mufindi in **Tanzania** to make printing/writing grades and kraft paper and board received further finance for personnel training and should be nearing startup.

The government of **Sudan** is looking at possible sites for a bagasse-printing/writing grades mill, and the nation's fourth paper company began operating in early 1984. In **Kenya**, the country's first mechanical pulp mill was to start up in mid-1984, and a small new newsprint mill is being planned. In **Morocco**, three new investments are due for completion over 1984-85, including a pulp line rebuild at Cellulose du Maroc, adding 20,000 tpy capacity.

Prospects for Africa's pulp and paper industry are brighter than they seemed to be in 1982 and early 1983. There is guarded optimism about recovery in 1984, and capacity should grow significantly over the next few years, reducing the heavy dependence on imports.

GLOSSARY OF INDUSTRY TERMS

A

ABRASION RESISTANCE. Resistance to the rubbing or wearing away by friction of a paper surface—including the paper itself as well as any printing or coatings on it.

ABSORBENCY. The property of paper that causes it to take up liquid or vapors it contacts.

AIR DRIED. Artificial drying of paper by contact with air over skeleton dryers after paper has been surface-sized.

ALUM. Aluminum sulfate, used to hard-size paper for improved water resistance.

APPARENT DENSITY. The weight per unit volume of a sheet, usually obtained by dividing the paper's basis weight by its caliper (thickness).

B

BOD (Biological Oxygen Demand). The amount of oxygen required for biological decomposition of waste in effluent (waste waters from the mill); an indirect measure of organic concentration in the effluent.

BASIS WEIGHT. The weight of a ream or other standardized measure of paper, expressed in pounds or in grams per square meter. By extension, the basis weight of one sheet of paper is the same as that of the standardized unit to which it belongs.

BASESTOCK. Paper that will be further processed, as in coating or laminating

BEATER. A large mixing tub where pulp or wastepaper is mixed with various additives, such as fillers, dyes and sizes. The action of the beater also serves to separate the pulp fibers.

BEATING. *See* Refining.

BINDERS BOARD. A paperboard grade, used in construction of hard-back book covers.

BISULFITE PULP. Sulfite pulp.

BOGUS. (Noun) Containerboard made from recycled waste materials. (Adjective) Used to describe any paper or board made from inferior materials.

BOND PAPER. A type of uncoated free-sheet paper used for stationery and printing.

BONDING STRENGTH. Also called "internal bonding strength." (1) The degree to which the fibers within a sheet of paper adhere to each other. (2) The strength of the bond between the paper or board stock and its coating or other surface application. (3) The extent to which the plies of a board or laminated sheet are bonded together.

BOOK PAPER. Uncoated free-sheet paper used in books and commercial printing.

BRIGHTNESS. The light-reflecting property of paper, measured against a reference standard.

BRISTOL. A heavyweight paper grade, solid or laminated, with caliper thickness of 0.006 in. and up, characterized by extreme hardness, foldability, and strength.

BROKE. Trimmings, manufacturing waste or damaged paper generated in a paper mill.

BULK. Term used to designate the thickness of a sheet of paper. A sheet with high bulk lacks compactness.

BURSTING STRENGTH (Mullen). The tensile strength and extensibility of paper or paperboard, measured as the pressure required to rupture a specimen in a specified instrument (Mullen) under specified conditions.

BUSINESS COMMUNICATION PAPERS. Papers for uses such as stationery, business forms, copier paper, checks and commercial printing.

C

CALENDER. An assembly of rolls at the end of the paper machine imparting a final finish to the paper, increasing gloss and smoothness.

CALENDER-FINISHED. Any paper with a surface glazed by calenders, such as machine finish, English finish, supercalendered and calender-friction glazed.

CALIPER. The thickness of a sheet measured under specified conditions. Caliper is usually expressed in thousandths of an inch (mils or points).

CARBONLESS COPY PAPER. A sheet capable of generating its own internal image, produced by pressure on its coated surface.

CARBONIZING PAPER. Lightweight basestock with proper finish on one or both sides, for later conversion into carbon paper.

CARLOAD. The minimum amount of paper required per freight car to qualify for shipment at the carload freight rate. This can be anywhere from 36,000 to 100,000 lb. Also refers to the amount of paper normally shipped in one freight car, since most shipments exceed the minimum carload requirement.

CASEMAKING MATERIALS. *See* Containerboard.

CAST-COATED PAPER. Gloss paper. A paper or board whose coating is allowed to harden or set while in contact with a finished casting surface. Cast-coated papers generally have a high gloss.

CELLULOSE. The chief structural element and main chemical constituent of the cell walls of trees and other plants; it comprises from 40% to 50% of wood and more than 98% of cotton fiber. Chemically, cellulose is a polymer composed of glucose monomers.

CELLULOSE WADDING. One or several layers of lightweight creped tissue, loose or bonded together, used for cushioning in packaging.

CHEMICAL PULP. Pulp obtained by the cooking of wood in an aqueous solution of various chemicals. The principal chemical pulp processes are the sulfite, sulfate (kraft) and soda.

CHEMITHERMOMECHANICAL PULP (CTMP). Pulpmaking process in which woodchips are treated with chemicals prior to or during presteaming, followed by atmospheric refining.

CHIPBOARD. Paperboard made from wastepapers, of relatively low density, used where strength and quality are not required.

CLARIFIER. Large settling basin used to remove solid waste material from mill effluent (waste waters).

COATED PAPER. Paper with surface coating that produces smooth finish, on one or both sides.

COATING. The layer of mixed clays and adhesives, etc. (or a plastic solution without pigment or binder) that is applied to the surface of paper or paperboard to create a new surface.

COMBINATION BOARD. Any paperboard made on a cylinder machine in which the outer plies (either one or both) are made from a different stock or are a different color than the middle layer.

COMBINED BOARD. A paperboard made by joining two or more boards together with an adhesive.

CONSTRUCTION PAPER. Heavy groundwood paper grade, in various colors, used for elementary school artwork.

CONSTRUCTION PAPER/BOARD. Construction papers (principally roofing felts) and building boards (insulation board and hard-pressed board), later converted into building products; usually not included in "paperboard" data.

CONTAINERBOARD. Linerboard and corrugating medium used in manufacturing corrugated shipping containers.

COOKING. Treating raw materials with chemicals under pressure and extreme heat to produce pulp for papermaking. Also referred to as "pulping."

CORD. The amount of wood contained in a pile of logs measuring 4 ft x 4 ft x 8 ft (128 ft^3). Approximately 85 ft^3 of solid wood.

CORRUGATED BOARD. Corrugating medium which has been passed through a corrugator and is pasted to a flat sheet of linerboard (single-faced corrugated board) or is pasted between two sheets of linerboard (double-faced corrugated board). The pasted sheets are designated as "containerboard."

CORRUGATING MEDIUM. Paperboard used as the fluted (corrugated) material in corrugated shipping containers. Also termed "ninepoint," which is the caliper of the board (0.009 in.).

COVER PAPER. Range of paper grades used for covers of catalogs, brochures and similar printed pieces.

CREPE PAPER. Paper given a crimped surface (by crowding it against a doctor blade during papermaking process), resulting in pliable, stretchable sheet.

CROSS DIRECTION. The direction at right angles to the machine direction in the plane of a sheet of paper.

CUNIT. 100 cubic feet of solid wood.

CURL. The tendency of paper by itself or in a laminate to bend or partly wrap around the axis of one of its directions.

CUT SIZE. Refers to business and writing papers that have been guillotined or rotary trimmed to dimensions of 8½x11 and 8½x14 in.; or any trimmed paper having dimensions of 16x21 in. or less.

CYLINDER MACHINE. A paper machine utilizing wire-covered cylinders or molds in which a web is formed from a dilute stock suspension.

D

DEINKING. The removal of ink, filler and other extraneous materials from printed or unprinted reclaimed papers through a combination of mechanical disintegration and chemical treatment, followed by washing, and, usually, bleaching. Flotation methods are also used to remove inks.

DIE CUT. The process by which paper or board is cut or stamped out to a specified shape or size with a steel die.

DIGESTER. Large reactor vessel in which wood is cooked in an aqueous solution to form chemical pulp.

DIMENSIONAL STABILITY. The property of a sheet of paper that relates to the constancy of its dimensions.

DUPLEX. Any paper or paperboard that has a different color, texture or finish on either side. Also, a general term applied to any multi-ply paper or board.

DRY END. The drying section of the paper machine in which the paper is dried and from which finished paper is wound onto a reel.

DRYERS. Steam-heated, hollow metal cylinders that dry the wet paper web as it passes around them in the paper machine.

E

ELECTROSTATIC PRINTING. A method of printing in which the ink is affixed to the web by electrostatic methods.

ELMENDORF TEST (Tear). A standard test for determining the tearing strength of paper. *See also* Tear.

ELONGATION (Stretch). Describes the "give" of a sheet of paper under tension, usually determined by means of a tensile tester.

EMBOSSED. A term applied to paper on which a raised or depressed design is pressed, die-stamped, or printed.

ENAMEL. Any glossy, shiny-surfaced, coated paper; also refers to a coating material on a paper.

ENCAPSULATED INK. Ink encapsulated with a coating giving a free-flowing dry system that can be activated by heat or pressure. Used for carbonless paper.

ENGLISH FINISH. Book paper with a finish more smooth than machine-finish and less smooth than supercalendered.

F

FABRIC. A fine-mesh woven screen on a paper machine on which paper is formed from a pulp slurry as water drains away.

FANFOLD. Continuous multiple-ply form manufactured from a single wide web that is folded longitudinally so as to form a flat pack, as differentiated from roll form. Also called zig-zag fold or flat pack.

FELT. A continuous belt made of wool or various combinations of wool, cotton, asbestos and/or synthetic fibers. Felts move the sheet through the paper machine, serving as a cushion and a medium for water removal.

FELT SIDE. The side of the paper web that has not been in contact with the wire during manufacture; the top side of the sheet.

FIBER. The threadlike units of vegetable growth that supply the structural basis of paper; also, synthetic filaments used in paper or other sheet materials ("synthetic fiber"). *See also* Secondary fiber.

FILLER. (1) A mineral pigment added to the fiber furnish to improve the opacity, color or printing qualities of paper. (2) In paperboard, the inner ply or plies as distinguished from the liners (outside plies).

FINE PAPER. A broad term for paper grades generally used for writing and printing, including bond, ledger, cover and book papers; as distinguished from wrapping and other coarse papers.

FINISH. (Noun) The surface property of a paper sheet determined by its surface contour and gloss (antique, eggshell, vellum, machine, English, supercalendered, plate, etc.). (Verb) To "finish" paper or paperboard is to cut, trim, sort and/or pack the paper, in finishing department of paper mill.

FLEXOGRAPHIC PRINTING. Formerly called aniline printing. A method of rotary letterpress printing that employs flexible plates and rapid-drying inks.

FLUFF PULP. Pulp, normally paper-grade kraft pulp, sold in rolls for fluffing. Fluff pulp is used as absorbent material in sanitary and health products.

FLUORESCENT PAPER. A paper that is coated with a fluorescent pigment that not only reflects a visible wavelength, but is activated by most of the remaining absorbed light to re-emit it as color of a longer wavelength, which results in reinforcement of the reflected color.

FORMATION. A property of paper that is determined by the degree of uniformity of distribution of the solid components of the sheet with special reference to the fibers.

FORMS BOND. *See* Register bond.

FOURDRINIER. A paper machine utilizing a horizontal, moving, fine-mesh screen on which paper is formed from a very dilute slurry of pulp and water.

FREE-SHEET. "Woodfree" paper containing 10% or less groundwood (mechanical) pulp.

FREENESS. The quality of pulp stock that determines the rate at which water drains from the stock suspension as it is being formed into a sheet on a wire mesh screen or perforated plate; usually measured on a Canadian Standard freeness tester, which has a perforated metal plate.

FURNISH. The mixture of various materials (pulp, sizes, wet-strength or other additives, fillers and/or dyes) that are blended in the stock suspension from which paper or paperboard is made.

G

GLASSINE PAPER. Translucent, smooth, grease-resistant paper made by extensive beating and subsequent supercalendering; made from primarily chemical pulps.

GLOSS. Light-reflective properties of a paper surface.

GRAIN. The direction in which the majority of fibers lie in the paper sheet, corresponding with the direction in which the paper is made on the machine ("machine direction").

GRAVURE PRINTING. An intaglio printing process employing minute engraved "wells." In general principle, deeply etched wells carry more ink than a raised surface, hence print darker values. Shallow wells are used to print light values. A doctor blade wipes the excess ink from the cylindrical printing surface. Rotogravure employs etched cylinders and web-fed stock. Sheet-fed gravure, as its name implies, involves individual sheet feeding.

GROUNDWOOD PULP. Pulp made by grinding wood with abrasive equipment (grinding stones) in the presence of water.

GROUNDWOOD PAPER. Paper containing a high percentage (over 10%) of groundwood pulp.

H

HAND. (Feel). A term used to express the impression obtained by handling paper to judge its finish, flexibility, and general quality.

HARD-SIZED. Any paper that has been treated with a large amount of size to make it highly water-resistant.

HARDWOOD. Wood from deciduous (broad-leaved) trees, having short fibers.

HEMICELLULOSE. A polysaccharide polymer associated with cellulose and also lignin in plant fibers; comprises between 20% and 30% of the chemical composition of wood.

HOLDOUT. The degree to which a sheet resists penetration by liquids, such as water or ink.

HOTMELTS. Molten plastics or waxes applied as a coating to paper or paperboard, forming an attractive, high-gloss surface with good flexible barrier properties (resistance to liquids and gases).

I

INDUSTRIAL PAPERS. Broad term covering papers manufactured for industrial uses, such as packaging, tissue and wrapping papers.

INTEGRATED MILL. A paper mill that produces all or almost all of the pulp it uses in papermaking.

INTERNAL BONDING STRENGTH. *See* Bonding strength.

J

JOB LOT. Out-of-specification paper that is sold at less than full price.

JUMBO ROLL. Industry term for large roll of paper.

K

KRAFT PAPER. Paper of high strength ("kraft"means strength in German), unbleached or bleached, produced from kraft (sulfate) pulp.

KRAFT PULP (Sulfate pulp). The strongest chemical pulp, made by the alkaline process of cooking wood in a solution of sodium hydroxide and sodium sulfide.

L

LACQUER. A solution or suspension of one or more materials in volatile solvents capable of forming a protective and/or decorative film, or a film with special surface properties, after the solvents have evaporated.

LAMINATED PAPER. Paper that is developed by fusing one or more layers of paper or paperboard together to the desired thickness and quality, or when other substances such as thin sheets of metal, plastic, cellophane, cloth, etc., are fused to paper.

LEDGER PAPER. A business paper grade, a strong sheet, used for accounting and records.

LETTERPRESS PRINTING. A printing process in which the ink is applied to paper, paperboard, or films from raised portions of printing plates or type.

LIGNIN. A complex, noncarbohydrate substance that, along with cellulose, forms and binds together the cell walls of plants; comprises between 20% and 40% of wood by weight.

LINERBOARD. Paperboard used as the outer, facing material in corrugated board used for shipping containers.

M

MICR (Magnetic Ink Character Recognition) PAPER. Writing papers that can be printed with magnetic ink, as used in data processing machines.

MACHINE-COATED. Paper that is coated, on one or both sides, on the paper machine.

MACHINE DIRECTION. Grain. The direction of the paper parallel to its forward movement on the paper machine.

MACHINE-FINISH (MF). (1) Any finish on a paper machine. It may be that of the sheet as it leaves the last dryer or as it leaves the calender stack, and either a dry or wet finish.
(2) When used with the name of a grade or type of paper, denotes a machine finish of less than the maximum range of smoothness.

MACHINE-GLAZED (MG) PAPER. Paper with a high, glossy finish on one side of the sheet only, made on a yankee machine and used for wrapping and poster work.

MANIFOLD. A lightweight, dense paper, usually in basis weight of 7 to 9 lb, with unglazed or machine-glazed finish, used primarily for carbon copies of typewritten material.

MATTE FINISH. A dull finish with little or no gloss.

MECHANICAL PULP. Pulp produced by mechanical rather than chemical processes; includes stone groundwood, refiner groundwood, thermomechanical, defibrated and exploded pulp. *See* chapter on Pulping Processes.

MEDIUM. *See* Corrugating medium.

MOISTURE CONTENT. Percent of moisture. The moisture present in a material, as determined by specified methods.

MOISTUREPROOF. The property of a material that makes it substantially impervious to water vapor.

MOISTURE VAPOR TRANSMISSION. The rate at which water vapor permeates a paper.

MOTTLE. Nonuniform coloring of a sheet of paper, whether intentional or accidental.

MULLEN. *See* Bursting strength.

MULTI-PLY. Consisting of two or more plies, or layers.

N

NEWSPRINT. A generic term used to describe paper of the type used for printing newspapers.

NINEPOINT. *See* Corrugating medium.

NONWOVEN FABRIC. A clothlike material made of fibers longer than those normally used in papermaking; instead of being woven on a loom, the fibers are matted together by means of several different processes, including formation on paper machines.

O

OCR (Optical Character Recognition). An information processing technology dealing with the conversion of imprinted or written data to another language and medium.

OFF-MACHINE COATED PAPER. Paper that is coated, on one or both sides, after it has been removed from the paper machine.

OFFSET PRINTING. A process of indirect printing in which an impression of type or a design on a flat plate is printed on a rubber-blanketed cylinder from which it is impressed ("off-set") upon the surface to be printed.

ONIONSKIN. Lightweight paper, basis weight 7 to 9 lb, often with cockle finish, used primarily for copies in office correspondence.

OPACITY. The property of a sheet of paper that obstructs the passage of light and prevents print or any object on or in contact with the other side from being seen through the sheet; the opposite of "showthrough."

P

PAPER. A web or sheet of fibers (primarily cellulose), formed on a fine wire or fabric from a water suspension.

PAPER STOCK. Wastepaper which is reused in manufacture of paper and paperboard, generally after it has been sorted into various recognized grades.

PAPETERIE. Woodfree paper used for stationery, greeting cards, etc.

PATENT COATED. Denotes a cylinder grade of boxboard that has been vat-lined on one or both sides with a white stock to improve the surface.

PICK. Refers to the tendency of fibers or particles of a sheet of paper to be pulled away from the sheet surface by tacky surfaces such as printing plates.

PIGMENT. A mineral or organic additive used to color paper or coating, or to develop opacity.

PLY. A web or layer of paper or paperboard.

POINT. Caliper measurement of a sheet of paper, in thousandths of an inch (0.001 in.).

POROSITY. The degree to which a paper contains connected air pockets. Porosity affects the absorbency of a paper, and is measured by determining the rate of air flow through a given sheet of paper in a densometer.

PRESSURE-SENSITIVE PAPER. Paper coated on one or both sides with adhesive, which is activated by pressure. Usually used in the manufacture of labels and tapes.

PRINTABILITY. Refers to paper properties that determine the quality of appearance of the sheet after printing, as judged by uniformity of color of the printed areas, uniformity of ink transfer, contrast, legibility, and so forth. Printability is determined by the paper's ink receptivity, uniformity, compressibility, smoothness, opacity, color and resistance to picking.

PULP. Primary raw material from which paper is made; a fibrous product produced by mechanical or chemical processes (or a combination). *See* chapter on Pulping Processes.

R

RAG CONTENT. Also called "cotton fiber content"; indicates that a percentage of a sheet of paper is made up of cotton fiber. For a paper to qualify as "rag-content paper," it must contain a minimum of 25% cotton fiber, and may be high as 100% cotton or "rag."

REAM. A quantity of sheets of paper, usually 500 sheets (in rare cases, 480 sheets).

REFINER MECHANICAL PULP (RMP). Pulpmaking process in which woodchips are refined under atmospheric conditions without pretreatment.

REFINING. The mechanical treatment of pulp in a water suspension to convert the fiber into a form suitable for papermaking.

REGISTER. The exact, corresponding placement of successively printed images.

REGISTER BOND. A lightweight bond paper used primarily for business forms and computer printouts.

RELATIVE HUMIDITY. The ratio of the amount of moisture in the air at any temperature to the amount required at that temperature to saturate the air.

RELEASE PAPER. A group of papers specifically designed for easy stripping from or nonadherence to tacky surfaces.

ROSIN. The residue obtained after distilling off the volatile matter (turpentine) from the gum of southern pine, commonly used for internal (beater) sizing.

ROTOGRAVURE PRINTING. *See* Gravure printing.

RUNABILITY. The efficiency with which a paper can be printed and handled in the press, and the paper's ability to withstand the stresses of the printing process unaltered.

S

SCREENINGS. Knots of pulp and other materials too coarse to pass through pulp or stock screens, separated or screened from the stock before it contacts the paper machine wire. Screenings are often used to make coarse papers or paperboards.

SECONDARY FIBER. Fiber that has been previously used for papermaking, including stock reclaimed from post-consumer wastepaper and converting plant waste as well as " broke" (*see* Broke).

SEMICHEMICAL. Pulp made by a combination of mechanical and chemical processes and usually used for corrugating medium.

SHEET. (1) A single leaf of paper as distinct from a roll. (2) Any paper not in roll form. (3) Paper, in general.

SILK SCREEN PRINTING. A method of printing in which the ink is forced through a design on a taut silk screen, made of bolting cloth, onto the object to be printed.

SILVICHEMICALS. Chemicals derived from wood, including byproduct chemicals from pulping processes.

SIZE. Any substance used in or on paper to make it water- or ink-resistant, such as rosin, glue, gelatin, starch, latex, synthetic resins.

SIZE PRESS. The section near the end of the paper machine where paper is surface-treated with starch or other sizing solutions.

SLURRY. A suspension in water or adhesive solution of pigments or other insoluble materials used in coating or papermaking.

SLUSH. A highly watery suspension of paper pulp that flows easily and can be pumped.

SODA PULP. Chemical pulp made principally from hardwoods by cooking the wood in a solution of caustic soda. Generally used in combination with bleached sulfite or kraft pulp for the manufacture of book and printing papers.

SOFTWOOD. Wood from coniferous (needled) trees, having long fibers.

SOLID BOARD. A general term indicating that the board is made of the same material throughout, as contrasted with a combination board in which two or more stocks are used.

SPENT LIQUOR. Cooking liquor that has been used in the manufacture of chemical pulp and that contains lignin, resins, and other substances extracted from wood.

SPLICE. The joining of the ends of two webs of paper to make a continuous roll.

STANDARD CONDITION. Standard conditions for paper testing, normally specified as 73° F ±2° and 50% ±3% relative humidity.

STARCH. The chief sizing agent used for paper.

STIFFNESS. The ability of paper or paperboard to resist deformation under stress.

STOCK. (1) Furnish. (2) Wet pulp of any type at any stage of the manufacturing process.

STRIKETHROUGH. Penetration of ink through a sheet of paper so that it shows through on the unprinted side.

SULFATE PULP. *See* Kraft pulp.

SULFITE PULP. Chemical pulp made by the acid process of cooking wood in a solution of sulfurous acid and a bisulfite salt. Bisulfite pulp.

SUPERCALENDER. Off-machine calender rolls that heat and iron paper to produce a high-gloss finish.

SURFACE-COATED. Term applied to paper or paperboard that has one or both sides coated with a pigment or other coating material.

SURFACE COLORING. The application of color to paper after the web has been formed on the paper machine; may be done on-machine at the calender rolls or off-machine as a separate operation.

SURFACE-SIZED. Any paper to which size has been applied when the sheet is dry or partially dry, at the size press or in a separate operation.

SYNTHETIC FIBER. Any manmade fiber, including those derived from cellulose, such as rayon and acetate, as well as the purely manmade, such as nylon and acrylic fiber.

T

TACK. The stickiness or pulling power of ink or adhesives.

TALL OIL. A byproduct of chemical pulping derived from spent liquors, containing principally rosin and fatty acids, with some sterols, alcohols, and other materials; used in soaps, lubricants, greases, rubber, paints, chemicals.

TARNISHPROOF PAPER. Refers to a paper being free of substances that will discolor or blemish copper or silver.

TEAR. The resistance of a sheet of paper to tearing; measured with an Elmendorf tear tester as the force in grams necessary to tear a strip of paper.

TENSILE STRENGTH. The force, parallel to the plane of the specimen, required to break a given width and length of paper under specified conditions.

TEST LINER. Bogus or recycled linerboard.

TEXT PAPER. High-quality printing papers.

THERMOMECHANICAL PULP (TMP). Pulpmaking process using presteaming and pressurized refining of untreated (no chemical treatment) woodchips.

TRANSPARENCY. That property of a material that transmits light rays so that objects can be distinctly seen through the specimen.

TRIM. The width of the sheet of paper at the dry end of a paper machine.

TWIN-WIRE MACHINE. A paper machine using two forming wires. Sections of the two wires are close to each other and parallel. A pulp slurry is injected between the two wires and water is removed from both sides of the sheet of paper as it is formed.

TWO-SIDEDNESS. Refers to the subtle yet definite difference in shade or texture between the felt and wire sides of a sheet of paper.

V

VEGETABLE PARCHMENT. A grease- and water-resistant paper resembling animal parchment made by passing unsized paper through sulfuric acid in order to gelatinize its surface, followed by washing and drying.

VELLUM FINISH. Toothy surface, relatively absorbent for fast ink penetration, usually applied to text papers.

W

WASTEPAPER. Pre-consumer waste (mostly trim and clippings from converting plants) and post-consumer waste (used newspapers, old corrugated containers, office waste, etc.) used in manufacture of paper and paperboard.

WEB. The continuous sheet of paper coming from the paper machine in its full width or from a roll of paper in any converting operation.

WET END. The front section of the paper machine where the pulp slurry is introduced for formation into paper.

WET MACHINE. A one-cylinder machine used to form pulp into thick, rough sheets sufficiently dry to permit folding into laps (bundles); also used to make certain types of heavy boards, the thick wet sheets being dried flat in specially constructed dryers.

WET STRENGTH. The tensile strength of a sheet of paper when completely wet; sometimes calculated as a percentage of its dry strength.

WET-STRENGTH PAPER. Paper with an extremely high resistance to tearing or disintegration when completely wet. To qualify as wet-strength paper, a sheet must retain over 15% of its dry tensile strength when saturated with water.

WHITE PAPERS. *See* Business communication papers.

WIRE. A fine-mesh metal wire or plastic screen on the paper machine on which paper is formed from a pulp slurry as water drains away.

WIRE MARK. The impression of the machine wire or dandy roll of the paper machine in the paper.

WIRE SIDE. The side of a sheet of paper that has had contact with the wire of the paper machine during manufacture. Paper from a twin-wire machine has two wire sides.

WOODFREE. Pulp: chemical pulp. Paper: Paper grades made from chemical pulp.

Y

YANKEE MACHINE. A type of fourdrinier or cylinder machine having a single drying cylinder with a highly polished surface, used for making machine-glazed paper or for drying tissue.

METRIC CONVERSION GUIDE

Pertinent conversion tables reproduced from "Metrication for the Pulp and Paper Industry" by Kenneth E. Lowe (Miller Freeman Publications, 1975)

CONVERSION LIST FOR NORTH AMERICAN AND METRIC UNITS

To convert	Into	Multiply by
acre	hectare	0.4047
Btu (mean)	joule	1.05587×10^{3}
centimeter	foot	0.03281
	inch	0.3937
cord	(see Forestry Terms)	
foot	centimeter	30.48
	meter	0.3048
gallon (U.S. liquid)	gallon (U.K.)	0.8327
	liter	3.785
gallon (U.K.)	gallon (U.S. liquid)	1.20094
	liter	4.545
horsepower (electric)	kilowatt	0.746
horsepower-hour	kilowatt-hour	0.746
inch	centimeter	2.54
	meter	0.0254
joule	Btu	9.4845×10^{-4}
	calorie (mean)	0.23866

To convert	Into	Multiply by
kilogram-mass	pound (avdp)	2.2046
	ton (metric)	0.001
	ton (short)	1.102×10^{-3}
kilometer	foot	3281
	mile (statute)	0.6214
kilowatt	horsepower (electric)	1.34
kilowatt-hour	horsepower-hour	1.34
liter	gallon (U.K.)	0.21998
	gallon (U.S. liquid)	0.2642
meter	foot	3.281
ounce (avdp)	gram	28.3495
	pound (avdp)	0.0625
pound (avdp)	kilogram	0.4536
pound/inch^2 (psi)	kilogram-force/cm^2	0.07031
square foot	square centimeter (cm^2)	929.0
	square meter (m^2)	0.09290
square meter	square foot (ft^2)	10.76
	square inch (in.^{2})	1550
ton (long)	ton (metric)	1.016
	ton (short)	1.120
ton (metric)	ton (long)	0.9842
	ton (short)	1.1023
ton (short)	ton (long)	0.89286
	ton (metric)	0.90718
yard	centimeter	9.144
	meter	0.9144

FACTORS FOR CONVERTING REAM AND BASIS WEIGHTS TO GRAMMAGE

Paper grade	Trade size 500-sheet ream (in.)	Grammage (g/m²) to ream or basis weight[1]	Ream weight[2] to grammage
Writing and printing	17 x 22	0.266	3.760
Demy size	17½ x 22½	0.280	3.571
Blotting	19 x 24	0.324	3.083
Cover	20 x 26	0.370	2.704
Tissue (double-crown size)	20 x 30	0.427	2.343
Cardboard	22 x 28	0.438	2.282
Bristol and tag	22½ x 28½	0.456	2.195
News and wrapping (3000 ft²)	24 x 36	0.614	1.627
Book	25 x 38	0.675	1.480
Former standard size	25 x 40	0.711	1.406
Paperboard	1000 ft²	0.205	4.881

Source: Based on TAPPI Standard T410.

Note: If the conversion factor for a sheet size is not listed, the ream weight or grammage can be calculated by the following formulas:

Converting ream weight (lb/500 sheets) to grammage:

$$\text{g/m}^2 = \frac{\text{ream weight} \times 1406}{\text{sheet area in square inches}}$$

Converting grammage to ream weight in lb/500 sheets:

$$\text{lb/ream} = \text{g/m}^2 \times \text{sheet area in square inches} \times 0.000711$$

[1] If the given trade size is in 480 sheets, then factor should be multiplied by 48/50 (or 0.960).

[2] If the given trade size is 480 sheets, then factor should be multiplied by 1.042.

COMPARISON OF ISO AND NORTH AMERICAN PAPER SIZES

ISO SIZES			NORTH AMERICAN SIZES		
	Milli-meters	Inches	meters	Milli- Inches	
A0	841 x 1189	33⅛ x 46¾	NA0	889 x 1143	35 x 45
A1	594 x 841	23⅜ x 33⅛	NA1	559 x 864	22 x 34
A2	420 x 594	16½ x 23⅜	NA2	432 x 559	17 x 22
A3	297 x 420	11⅔ x 16½	NA3	279 x 432	11 x 17
A4	210 x 297	8¼ x 11¾	NA4	216 x 279	8½ x 11
A5	148 x 210	5⅞ x 8¼	NA5	139 x 216	5½ x 8½
A6	105 x 148	4⅛ x 5⅞	NA6	108 x 139	4¼ x 5½

METRIC UNITS FOR COMMONLY USED TERMS IN FORESTRY

Term	North American symbol or definition	Suggested metric unit	Equivalent
LAND AREA			
Acre		hectare (ha)	1 acre = 0.4047 ha
Square mile	640 acres	hectare (ha)	1 mi^2 = 259.0 ha
		square kilometer (km^2)	1 mi^2 = 2.59 km^2
Section	640 acres	hectare (ha)	1 section = 2.59 km
Township	36 square miles (mi^2)	hectare (ha)	1 township = 9324 ha
LUMBER AND BOARD MEASUREMENTS			
Board foot	bdf	cubic meter (m^3)	1 bdf = 0.002360 m^3
1000 board feet	1000 bdf	cubic meter (m^3)	1000 bdf = 2.360 m^3
Cubic foot	ft^3	cubic meter (m^3)	1 ft^3 = 0.02832 m^3
Square foot	ft^2	square meter (m^2)	1 ft^2 = 0.09290 m^2
Thickness	in.	millimeter (mm)	1 in. = 25.4 mm
WOOD AND PULPWOOD MEASUREMENTS			
Cord	128 ft^3	cubic meter (m^3)	1 cord = 3.624 m^3
Unit	160 ft^3 (wood)	cubic meter (m^3)	1 unit (160 ft^3) = 4.528 m^3
	200 ft^3 (chip)	cubic meter (m^3)	1 unit (200 ft^3) = 5.664 m^3
Cunit	100 ft^3 (solid)	cubic meter (m^3)	1 cunit = 2.832 m^3
Cubic foot	ft^3	cubic meter (m^3)	1 ft^3 = 0.02832 m^3
Yield/acre	ft^3/acre	cubic meter/hectare (m^3/ha)	1 ft^3/acre = 0.06998 m^3/ha

CONVERSIONS FOR ACCOUNTING

Unit cost	Multiply by	To obtain
AREA		
$/acre	2.47105	$/hectare
$/square foot	10.7639	$/square meter
$/1000 square feet	0.0107639	$/square meter
	10.7639	$/1000 square meters
$/3000 square feet	0.0035879	$/square meter
ELECTRICAL		
$/kilowatt-hour	1.0	$/kilowatt-hour
	0.277778	$/megajoule
ENERGY		
$/cubic foot (gas)	35.3147	$/cubic meter
$/1000 cubic foot (gas)	35.3147	$/1000 cubic meters
$/gallon (U.S.)	(see Volume)	
$/gallon (U.K. liquid)	(see Volume)	
FREIGHT		
$/ton (2000 lb)	(see Weight)	$/metric ton
$/ton-mile	0.6849	$/metric ton-kilometer
LABOR		
ton (2000 lb)/man-day	0.9072	metric ton/man-day
$/ton (2000 lb)	1.10231	$/metric ton
VOLUME		
$/gallon (U.S.)	0.264173	$/liter
	264.173	$/cubic meter
$/gallon (U.K.)	0.219969	$/liter
	219.969	$/cubic meter
$/1000 gallons (U.S.)	0.264173	$/1000 liters
	0.264173	$/cubic meter
$/million gallons (U.S.)	0.264173	$/1000 cubic meters
$/cubic foot	35.3147	$/cubic meter
$/cubic yard	1.30795	$/cubic meter

Unit cost	Multiply by	To obtain
WEIGHT (MASS)		
\$/pound	2.20462	\$/kilogram
\$/100 pound (cwt)	0.0220462	\$/kilogram
\$/short ton (2000 lb)	1.10231 (0.9072)	\$/metric ton
\$/long ton (2240 lb)	0.984206	\$/metric ton
WOOD VOLUME		
\$/board foot	423.76	\$/cubic meter
\$/1000 board feet	0.42376	\$/cubic meter
\$/cubic foot	35.3147	\$/cubic meter
\$/cord (128 ft^3)	0.2759	\$/cubic meter
\$/unit (wood)	0.2208	\$/cubic meter
\$/unit (chip)	0.1766	\$/cubic meter
\$/cunit (100 ft^3)	0.3531	\$/cubic meter

For example, assume the selling price for 42-lb linerboard is \$300/ton. Calculate the price per 1000 m^2:

$$\frac{300 \times 42.0}{2000} = \$6.30/1000\ \text{ft}^2\text{; thus}$$

$$6.30 \times 10.764 = \$67.81/1000\ \text{m}^2$$

Another formula for calculating price on a 1000-m^2 basis is:

$$\$/1000\ \text{m}^2 = (\$/\text{metric ton})\ (\text{grammage})\ (0.001)$$

For example, assume that the selling price of linerboard with a grammage of 205 g/m^2 is \$400/metric ton. Calculate the price per 1000 m^2:

$$400 \times 205 \times 0.001 = \$82.00/1000\ \text{m}^2$$

SOURCES OF INDUSTRY INFORMATION

This section is a listing of publications about the pulp and paper industry, with emphasis on economics and marketing aspects and excluding manufacturing technology. Periodicals, books and special studies are listed alphabetically by title, with frequency of publication (or date of issue), and name and address of publisher or distributor.

Special reports and surveys (generally priced at $1,000 or higher) are listed in a second section.

Firms providing special market reports are listed in the final section.

Annual Review of Pulp and Paper Mill Projects Worldwide (annual)
Jaakko Pöyry Oy
P.O. Box 16, SF-00441 Helsinki, Finland

Boxboard Containers (monthly)
Maclean-Hunter Publishing Corp.
300 W. Adams St., Chicago, Ill. 60606

Canada: Exports by Commodities and Countries
(Catalog 65-004—includes pulp & paper grades; monthly)
Statistics Canada
Publications Distribution, User Services Div.
Ottawa, Ont. K1A 0T6, Canada

Canada: Imports by Commodities and Countries
(Catalog 65-007—includes pulp & paper grades; monthly)
Statistics Canada
Publications Distribution, User Services Div.
Ottawa, Ont. K1A 0T6, Canada

Canadian Paper Analyst (monthly)
JDR Publications
P.O. Box 300, Victoria Station
Westmount, Que. H3Z 2V5, Canada

Canadian Pulp and Paper Capacity (annual)
Canadian Pulp & Paper Assn.
2300 Sun Life Bldg., Montreal, Que. H3B 2X9, Canada

Capacity Survey (annual)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Capital Spending
(*see* Mill-by-Mill Listings)

1982 Census of Manufactures
Pulp Mills (SIC 2611)
Paper Mills, except Building Paper (SIC 2621)
Paperboard Mills (SIC 2631)
Building Paper & Board Mills (SIC 2661)
other SIC 26 reports available
U.S. Dept. of Commerce, Bureau of Census
Subscriber Services (Publications)
Washington, D.C. 20233

1982 Census of Manufactures, Vol. 2, Industry Statistics, Part 1, SIC major groups 20-26
Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Competitive Grade Finder for the Paper and Graphic Arts Industry (annual)
Grade Finders Inc.
P.O. Box 444, Bala-Cynwyd, Pa. 19004

Current Industrial Reports: Pulp, Paper & Board—M26A (annual)
U.S. Dept of Commerce, Bureau of Census
Subscriber Services (Publications)
Washington, D.C. 20233

Dictionary of Paper (Fourth edition, 1980)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Estimated Production of Pulp, Paper and Paperboard in Certain Countries (annual)
Food & Agriculture Organization, United Nations
Via della Terme di Caracalla, 00100 Rome, Italy

Exports of Linerboard and Corrugating Material (annual)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Fibre Box Industry Annual Report (annual)
Fibre Box Assn.
5725 N. East River Rd., Chicago, Ill. 60631

Fibre Market News (two times a week)
Market News Publishing Corp.
156 Fifth Ave., New York, N.Y. 10010

Fiber Statistics Subscription Service
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Forest Products and Paper Industry (monthly)
Evadna S. Lynn and Richard S. Palm
Merrill Lynch, Pierce, Fenner & Smith Inc.
Securities Research Division
165 Broadway, New York, N.Y. 10080

Hay-Roe's PaperTree Letter (monthly)
PaperTree Economics Ltd.
105—900 W. Georgia St., Vancouver, B.C. V6C 1P9, Canada

Industrial Paper and Board Products (semiannual)
Data-Transcripts
90 High St., Wingham, Kent CT3 1DE, U.K.

International Competition in Pulp, Paper and Paperboard: the Future North American Position and its Implications (1982)
By Arthur D. Little Inc.
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

International Directory of the Nonwoven Fabrics Industry (biennial—1983-84)
Assn. of Nonwoven Fabrics Industry
1700 Broadway, New York, N.Y. 10019

International Glossary of Technical Terms for the Pulp and Paper Industry (1976)
Edited by PULP & PAPER INTERNATIONAL
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

International Report (intermittent)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Kline Guide to the Paper Industry (triennial)
Charles H. Kline & Co. Inc.
330 Passaic Ave., Fairfield, N.J. 07006

Lockwood's Directory of the Paper and Allied Trades (annual)
Vance Publishing Corp.
122 East 42nd St., New York, N.Y. 10168

Market Pulp—Supply/Demand Update (1983)
Edited by PULP & PAPER INTERNATIONAL
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Metrication for the Pulp and Paper Industry (1975)
By Kenneth E. Lowe
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Mill-by-Mill Listings (semiannual)
PULP & PAPER Project Report
500 Howard St., San Francisco, Calif. 94105

Monthly Newsprint Statistics (monthly)
Canadian Pulp & Paper Assn.
2300 Sun Life Bldg., Montreal, Que. H3B 2X9, Canada

Monthly Report on Pulp and Paper Mill Projects in the World (11 issues a year)
Jaakko Pöyry Oy
Box 16, SF-00441 Helsinki, Finland

Monthly Paper Stock Statistics (monthly)
National Assn. of Recycling Industries Inc.
330 Madison Ave., New York, N.Y. 10017

Monthly Pulpwood Summary (monthly)
American Pulpwood Assn.
1619 Massachusetts Ave. N.W.
Washington, D.C. 20036

Monthly Statistical Summary (monthly)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Newsprint Data (annual)
Canadian Pulp & Paper Assn.
2300 Sun Life Bldg., Montreal, Que. H3B 2X9, Canada

North America in the 80s: Pulp, Paper and Paperboard: the Competitive Position and its Implications (1980)
By A.D. Little Inc. and Pulp & Paper International
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Official Board Markets (weekly)
Harcourt Brace Jovanovich Inc.
111 E. Wacker Dr., Chicago, Ill. 60601

Outlook for the North American Pulp and Paper Industry (1984)
Andover International Associates Inc.
130 Centre St., Danvers, Mass. 01923

PPI/Pulp & Paper International(monthly)
Miller Freeman Publications
Chaussée de Charleroi 123a, Bte 5
B-1060 Brussels, Belgium

also 500 Howard St., San Francisco, Calif. 94105

PPI Capital Investment Service (update as ordered)
Pulp & Paper International
Chaussée de Charleroi, 123a, Bte 5
B-1060 Brussels, Belgium

PPI/International Pulp & Paper Directory (biennial)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

PPI Map of the European Pulp & Paper Industry (1984)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

PPI Newswire Service (weekly—48 times a year)
PPI Newswire Service
Chaussée de Charleroi 123a, Bte 5
B-1060 Brussels, Belgium

PPI Top 100 Companies in World (annual)
Pulp & Paper International
500 Howard St., San Francisco, Calif. 94105

Paper (semi-monthly)
Benn Publications Ltd.
Sovereign Way, Tonbridge, Kent TN9 1RW, U.K.

Paper Age (monthly)
Business Press Inc.
101 West St., Hillsdale, N.J. 07642

Paper and Paperboard: Manufacturing and Converting Fundamentals (1982)
By James E. Kline
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Paper Basics (1978)
By David Saltman
Van Nostrand Reinhold Co.
130 W. 50th St., New York, N.Y. 10020

Paper, Film & Foil Converter (monthly)
Maclean-Hunter Publishing Corp.
300 W. Adams St., Chicago, Ill. 60606

Paper Industry Long-term Forecast 1983-92 (1983)
CIS Communication & Information Services
P.O. Box 5923, Concord, Calif. 94524

Paper Industry Monthly (monthly)
Thomas P. Clephane and Jeanne Carroll
Morgan Stanley, Investment Research
1251 Ave. of the Americas, New York, N.Y. 10020

Paper Industry: Outlook for Market Pulp (1981)
Kidder, Peabody & Co., Institutional Services Dept.
10 Hanover Square, New York, N.Y. 10005

Paper Merchant Sales Report (monthly)
National Paper Trade Assn.
111 Great Neck Rd., Great Neck, N.Y. 11021

Paper Production Report (weekly)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Paper Sales (monthly)
Harcourt Brace Jovanovich Inc.
120 W. Second St., Duluth, Minn. 55802

Paper Trade Journal (monthly)
Vance Publishing Corp.
400 Knightsbridge Pkwy., Lincolnshire, Ill. 60069

Paper Year Book (annual)
Harcourt Brace Jovanovich Inc.
120 W. Second St., Duluth, Minn. 55802

Paperboard Packaging (monthly)
Harcourt Brace Jovanovich Inc.
120 W. Second St., Duluth, Minn. 55802

Pima (monthly)
Pima (Paper Industry Management Assn.)
2400 E. Oakton St., Arlington Heights, Ill. 60005

Pima Directory (annual)
Pima (Paper Industry Management Assn.)
2400 E. Oakton St., Arlington Heights, Ill. 60005

Pima Pulp & Paper Mill Catalog (annual)
Pima (Paper Industry Management Assn.)
2400 E. Oakton St., Arlington Heights, Ill. 60005

Pocket Pal/Graphic Arts Production Handbook
(13th edition—1983)
International Paper Co.
77 W. 45th St., New York, N.Y. 10036

Post's Pulp & Paper Directory (annual)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Presstime (monthly)
American Newspaper Publishers Assn.
Box 17407, Dulles International Airport
Washington, D.C. 20041

Price/Export-Import Databook 1980 (1980)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Printing and Graphic Arts Buyers (annual)
Hilary House Publishers Inc.
1033 Channel Dr., Hewlett Harbor, N.Y. 11557

Production, Prices, Employment & Trade in Northwest Forest Industries (quarterly)
Pacific Northwest Forest & Range Experiment
Station, Forest Service, U.S. Dept. of Agriculture
809 N.E. 6th Ave., Portland, Ore. 97232

Profits and Markets in the Global Paper, Paperboard, and Packaging Industries (1983)
Compiled by Euro-Data Analysts, U.K.
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Projected Pulp and Paper Mills in the World (annual)
Food & Agriculture Organization, United Nations
Via delle Terme di Caracalla, 00100 Rome, Italy

Publications Papers: An appraisal of the future of paper, printing and publishing at start of the electronic era (1983)
Edited by PULP & PAPER INTERNATIONAL
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

PULP & PAPER (monthly except twice in November)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

PULP & PAPER Buyers Guide (annual)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Pulp & Paper Canada (monthly)
Southam Business Publications
310 Victoria Ave., Westmount, Que. H3Z 2M9, Canada

Pulp & Paper Canada Annual and Directory (annual)
Southam Business Publications
310 Victoria Ave., Westmount, Que. H3Z 2M9, Canada

Pulp and Paper Capacities (annual)
Food & Agriculture Organization, United Nations
Via delle Terme di Caracalla, 00100 Rome, Italy

Pulp and Paper Journal (8 times a year)
Maclean-Hunter Ltd.
777 Bay St., Toronto, Ont. M5W 1A7, Canada

PULP & PAPER Mill Map (1985)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Pulp and Paper Mills (Catalog No. 36-204—annual)
Statistics Canada
Publications Distribution, User Services Div.
Ottawa, Ont. K1A 0T6, Canada

PULP & PAPER PRICEBOOK (1984)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

PULP & PAPER Project Report (monthly, with semiannual Mill-by-Mill Listings supplement)
Miller Freeman Publication
500 Howard St., San Francisco, Calif. 94105

Pulp and Paper/Quarterly Statistics (quarterly)
OECD/Organization for Economic Cooperation
and Development, Paris, France
OECD Publications Center
1750 Pennsylvania Ave. N.W.
Washington, D.C. 20006

PULP & PAPER WEEK (weekly—48 times a year)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Pulp, Paper and Paperboard Industry: Profits, Future Development & Investment Risk, a Global Scenario (1982)
Compiled by Euro-Data Analysts, U.K.
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Pulpwood and Wood Residue Statistics (Catalog No. 25-001—monthly)
Statistics Canada
Publications Distribution, User Services Div.
Ottawa, Ont. K1A 0T6, Canada

Recognition Rankings of suppliers to the pulp and paper industry (biennial)
PULP & PAPER, Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Reference Tables (annual)
Canadian Pulp & Paper Assn.
2300 Sun Life Bldg., Montreal, Que. H3B 2X9,
Canada

SOS/Sources of Supply Buyers Guide (annual)
Advertisers & Publishers Service Inc.
300 N. Prospect Ave., Park Ridge, Ill. 60068

Short-term Review of International Pulp & Paper Markets, Worldwide (quarterly)
Jaakko Pöyry Oy
Box 16, SF-00441 Helsinki, Finland

Southern Pulp & Paper (monthly except twice in Oct.)
Ernest H. Abernethy Publishing Co. Inc.
75 Third St. N.W., Atlanta, Ga. 30365

Specialty Papers and Products Record (monthly)
Data-Transcripts
90 High St., Wingham, Kent CT3 1DE, U.K.

Statistical Bulletin (monthly)
Canadian Pulp & Paper Assn.
2300 Sun Life Bldg., Montreal, Que. H3B 2X9,
Canada

Statistical Bulletin/Containerboard Shipments, Consumption, Inventory (monthly)
Fibre Box Assn.
5725 E. River Rd., Chicago, Ill. 60631

Statistics of Paper and Paperboard (annual)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Tappi Journal (monthly)
TAPPI (Technical Assn. of Pulp & Paper Industry)
P.O. Box 105113, Technology Park/Atlanta
Atlanta, Ga. 30348

Tappi Journal Directory (annual)
TAPPI (Technical Assn. of Pulp & Paper Industry)
P.O. Box 105113, Technology Park/Atlanta
Atlanta, Ga. 30348

Timber Mart-South (monthly)
Timber Mart-South Inc. (with Data Resources Inc.)
P.O. Box 1278, Highlands, N.C. 28741

Timber Mart-South Yearbook (annual)
Data Resources Inc.
24 Hartwell Ave., Lexington, Mass. 02173

Timberland Prices in the United States (1983)
Gerald S. Gilligan & Associates
1 Strawberry Hill, Stamford, Conn. 06902

Transport and Handling in the Pulp and Paper Industry Vols. 3 (1979), 4 (1981), and 5 (1984)
Edited by Pulp & Paper International
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

U.S. Exports, Schedule E, Commodity by Country
(Catalog FT410—includes pulp & paper grades; monthly)
Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

U.S. Exports of Pulp, Paper, Paperboard and Converted Products (annual)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

U.S. Exports of Wastepaper by Destination (annual)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

U.S. Imports, Schedule A, Commodity by Country
(Catalog FT135—includes pulp & paper grades; monthly)
Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

U.S. Secondary Fibre Study: Regional Outlook for U.S. Secondary Fibre Demand, Supply & Prices through 1993 (1983)
Data Resources Inc.
24 Hartwell Ave., Lexington, Mass. 02173

U.S. Woodpulp Data (monthly)
American Paper Institute
Pulp, Materials & Technology Group
260 Madison Ave., New York, N.Y. 10016

Uncoated Groundwood Papers (1984)
Edited by Pulp & Paper
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Walden's ABC Guide and Paper Production Yearbook (annual)
Walden-Mott Corp.
475 Kinderkamack Rd., Oradell, N.J. 07649

Walden's Fiber & Board Report (semimonthly)
Walden-Mott Corp.
475 Kinderkamack Rd., Oradell, N.J. 07649

Walden's Handbook/For Paper Salespeople and Buyers (second edition, 1981)
Walden-Mott Corp.
475 Kinderkamack Rd., Oradell, N.J. 07649

Walden's Paper Catalog (2 times a year, in 6 regional editions)
Walden-Mott Corp.
475 Kinderkamack Rd., Oradell, N.J. 07649

Walden's Paper Report (twice monthly)
Walden-Mott Corp.
475 Kinderkamack Rd., Oradell, N.J. 07649

Who's Who in Paper Distribution & Factbook (annual)
National Paper Trade Assn.
111 Great Neck Road, Great Neck, N.Y. 11021

Wood Pulp & Fiber Statistics (annual)
American Paper Institute
Pulp, Materials & Technology Group
260 Madison Ave., New York, N.Y. 10016

World Market Pulp Study: Outlook for Norscan & Brazilian Market Pulp through 1992 (1983)
Data Resources Inc.
24 Hartwell Ave., Lexington, Mass. 02173

SPECIAL REPORTS AND SURVEYS (generally priced at least $1000)

Absorbent Products Market, Part I: Competition in Markets for Baby Diapers, Feminine Pads and Tampons (1984)
Marketing/Technology Service
3125 W. Main St., Kalamazoo, Mich. 49007

Absorbent Products Markets, Part II: Adult Incontinent Products (1984)
Marketing/Technology Service
3125 W. Main St., Kalamazoo, Mich. 49007

Advances in Forming & Bonding: Fiber Furnish & Tissue, Wipe & Towel Quality, Nonwovens & Paper (1983)
Marketing/Technology Service
3125 W. Main St., Kalamazoo, Mich. 49007

Changes in Demand for Market Pulp and Western Europe (semiannual)
BIS Marketing Research Ltd.
York House, 199 Westminster Bridge Rd.
London SE1 7UT, England

Chemical Markets for Mechanical Pulp Products in North America (1981)
Gorham International Inc.
Gorham, Maine 04038

Competition in Consumer Tissue Markets (1983)
Marketing/Technology Service
3125 W. Main St., Kalamazoo, Mich. 49007

Developing Markets for Paper Containing Synthetic Pulps and Fibers, a Critical Analysis (1980)
R M Associates
151 E. Forest Ave., Neenah, Wis. 54956

Facing Materials: New Development and Applications for Absorbent Products (1983)
Marketing/Technology Service
3125 W. Main St., Kalamazoo, Mich. 49007

Facsimile Papers Markets—an Updated Report (1981)
Gorham International Inc.
Gorham, Maine 04038

Financial Performance of Major Forest Product Companies in Western Europe and North America (1984)
Jaakko Pöyry Oy
P.O. Box 16, SF-00441 Helsinki, Finland

Grocer's Checkout Sack—1983 (1983)
Phillip Townsend Associates Inc.
P.O. Box 90327, Houston, Texas 77290

Ink Jet Printing: Current Status and Future Prospects (1984)
Gorham International Inc.
Gorham, Maine 04038

Long-term Outlook for Printing and Writing Papers in Western Europe (1984)
Jaakko Pöyry Oy
Box 16, SF-00441 Helsinki, Finland

1984-85 Paper Availability Outlook (1984)
Strategic Futures Inc.
595 Madison Ave., New York, N.Y. 10022

Paper and Forest Products (annual)
Paine Webber Mitchell Hutchins Inc.
One Battery Park Plaza, New York, N.Y. 10004

Paper Demand and Supply—Future Development (1982; 5 volumes)
Jaakko Pöyry Oy
Box 16, SF-00441 Helsinki, Finland

Paper Machine Reports (to customer specifications)
Jaakko Pöyry Oy
P.O. Box 16, SF-00441 Helsinki, Finland

Pulp and Paper Equipment Market (1983)
Frost & Sullivan Inc.
106 Fulton St., New York, N.Y. 10038

Pulp Mill Reports (to customer specifications)
Jaakko Pöyry Oy
P.O. Box 16, SF-00441 Helsinki, Finland

Release Papers: Value Added Specialties (1983)
Gorham International Inc.
Gorham, Maine 04038

Study of Incontinence: Part I, General Population; Part II, Study of Incontinence in Institutions; Part III, Health Care Professional Survey (1984)
Marketing/Technology Service Inc.
3125 S. Main St., Kalamazoo, Mich. 49007

Thermal Bonding—Technology and Applications (1984)
Marketing/Technology Service Inc.
3125 W. Main St., Kalamazoo, Mich, 49007

Thermal Printing Papers—an Evaluation of Business in a Growing Market (1983)
Gorham International Inc.
Gorham, Maine 04038

U.S. Wipe and Towel Markets—Nonwovens and Paper (1983)
Marketing/Technology Service
3125 W. Main St., Kalamazoo, Mich. 40997

World Paper and Board (1983)
Predicasts Inc.
200 University Circle Research Center
11001 Cedar Ave., Cleveland, Ohio 44106

World Pulp and other Fibrous Materials (1983)
Predicasts Inc.
200 University Circle Research Center
11001 Cedar Ave., Cleveland, Ohio 44106

SPECIAL MARKET REPORTS (list on request to publishers)

Andover International Associates Inc.
130 Centre St., Danvers, Mass. 01923

BIS Marketing Research Ltd.
York House, 199 Westminstser Bridge Rd.
London SE1 7UT, U.K.

CIS Communication & Information Services
P.O. Box 5923, Concord, Calif. 94524

Copeland Economics Group
880 Canal St., Stamford, Conn. 06902

Data Resources Inc., Forest Products Div.
24 Hartwell Ave., Lexington, Mass. 02173

Euro-Data Analysts
7 Priors, Ashtead, Surrey KT21 2QF, U.K.

Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Frost & Sullivan Inc.
106 Fulton St., New York, N.Y. 10038

Gorham International Inc.
Gorham, Maine 04038

A. D. Little Inc.
Acorn Park, Cambridge, Mass. 02140

Marketing/Technology Service
3125 W. Main St., Kalamazoo, Mich. 496007

Jaakko Poyry Oy
P.O. Box 16, SF-00441 Helsinki, Finland

Predicasts Inc.
11001 Cedar Ave., Cleveland, Ohio 44106

R M Associates
151 E. Forest Ave., Neenah, Wis. 54956

SRI International
333 Ravenswood, Ave., Menlo Park, Calif. 94025

Sabre Associates Inc.
P.O. Box 486 Belden Stn., Norwalk, Conn. 06852

Strategic Futures Inc.
595 Madison Ave., New York, N.Y. 10022

Phillip Townsend Associates Inc.
P.O. Box 90327, Houston, Texas 77290

COMPANY PROFILES

This section is a directory of all pulp- and papermaking facilities in United States and Canada. It is divided into two parts:

MAJOR FIRMS (1,000-tpd capacity)

Included in these listings are companies with daily production capacity of at least 1,000 short tons (or 900 metric tons) of pulp and paper combined. All pulp produced at a millsite, whether shipped as market pulp or consumed onsite in papermaking, is counted.

Sales and earnings figures for 1982 and 1983 are given (where available) and a brief financial description of each company is presented. All pulp and paper/board production sites are listed, showing grades and capacity.

Operations are listed under the name of the corporate owner, excepting non-paper/board-industry owners. Subsidiaries and joint ventures in U.S. and Canada are included under the parent firm. Foreign operations are not listed.

ALL-INCLUSIVE INDUSTRY GUIDE

This section presents production capacity and financial data (where available) on all U.S. and Canadian pulp and paper firms. Operations are listed under the corporate owner.

Subsidiary companies and joint ventures are cross-referenced. All companies in "Major Firms (1,000-tpd capacity)" listings are cross-referenced.

FINANCIAL DATA

All sales and earnings figures are shown in U.S. dollars, unless indicated "C$" for Canadian dollars.

PRODUCTION DATA

All capacity production data are in short tons of 2000 lb, unless specifically indicated as metric.

To convert to metric tons:

multiply by 0.90718

COMPANY PROFILES
Major firms (1,000 tpd capacity)

A listing of U.S. and Canadian companies with daily production capacity of 1,000 short tons or more, counting facilities for pulp, paper and paperboard, and building board grades.

Abitibi-Price Inc.

Toronto-Dominion Centre
Toronto, Ont. M5K 1B3
Robert C. Gimlin, chairman/chief executive officer

(Abitibi-Price is owned 93% by Olympia & York Developments Ltd. It has two joint ventures: Gaspesia Pulp & Paper Co., subsidiary of Price (51%); Augusta Newsprint Co. (50%).)

Net sales (C$):	
1983	$1,660,180,000
1982	1,634,262,000
Net earnings (C$):	
1983	38,013,000
1982	61,287,000

In late 1983, Abitibi agreed to sell the kraft pulp/paperboard mill at Jonquiere, Que., and in early 1984, accepted a purchase offer for the groundwood papers mill at Sault Ste. Marie, Ont.

Paper production at Abitibi mills in 1983 totaled 1,948,000 metric tons; pulp output was 193,000 tons.

Abitibi's C$305-million capital program for 1983-84 included completion of three major projects: startup of a new 190,000-m-tpy newsprint machine at the Iroquois Falls, Ont., mill, in spring 1983; startup of a 205,000-m-tpy newsprint machine at the joint-venture Augusta Newsprint mill in Augusta, Ga., in fall; and completion of conversion of the Beaupre, Que., mill from newsprint to 145,000-m-tpy groundwood specialties, onstream in Nov. 1983. Spending, excluding the Augusta project, was budgeted at C$133 million in 1983 and $147 million in 1984.

Abitibi owns or has cutting rights on 42,168 square miles (approximately 27 million acres) of timberland in Canada and U.S.

Production facilities:

AUGUSTA, GA.
(Augusta Newsprint)
Pulp—450 metric tpd groundwood; 700 tpd thermomechanical
Newsprint—975 metric tpd

PINE FALLS, MAN.
Pulp—136 metric tpd sulfite; 408 tpd groundwood
Newsprint—472 metric tpd

GRAND FALLS, NFLD.
(Price (Nfld) Pulp & Paper)
Pulp—250 metric tpd sulfite; 800 tpd thermomechanical
Newsprint—700 metric tpd

STEPHENVILLE, NFLD.
(Stephenville Div.)
Pulp—600 metric tpd thermomechanical
Newsprint—475 metric tpd

GEORGETOWN, ONT.
(Abitibi-Price Fine Papers)
Printing/writing papers—45 metric tpd

IROQUOIS FALLS, ONT.
Pulp—250 metric tpd sulfite, 760 tpd groundwood
Newsprint—825 metric tpd; wrapper—41 tpd

SMOOTH ROCK FALLS, ONT.
Pulp—315 metric tpd kraft (for market)

THUNDER BAY, ONT.
(Provincial Papers)
Pulp—61 metric tpd groundwood
Printing/writing papers—318 metric tpd

THUNDER BAY, ONT.
(Fort William Div.)
Pulp—136 metric tpd SCMP; 299 tpd groundwood
Newsprint—385 metric tpd

THUNDER BAY, ONT.
(Thunder Bay Div.)
Pulp—136 metric tpd sulfite; 408 tpd groundwood
Newsprint—426 metric tpd

ALMA, QUE.
(Price Co.)
Pulp—218 metric tpd sulfite; 708 tpd groundwood
Newsprint—750 metric tpd

BEAUPRE, QUE.
Pulp—550 metric tpd thermochemimechanical (TCMP)
Groundwood specialties—381 metric tpd

CHANDLER, QUE.
(Gaspesia Pulp & Paper Co.)
Pulp—136 metric tpd sulfite; 408 groundwood; 36 tpd refiner mechanical
Newsprint—617 metric tpd

JONQUIERE, QUE.
(Price/Kenogami groundwood)
Pulp—299 metric tpd groundwood; 327 tpd thermochemimechanical (TCMP)
Groundwood specialties—720 metric tpd

LaCHUTE, QUE.
(Price Wilson)
Packaging, toweling papers—21 metric tpd

Total production capacity:

PULP	
Groundwood	3,801 metric tpd
Kraft	315 metric tpd
SCMP	136 metric tpd
Refiner mechanical	36 metric tpd
Sulfite	1,126 metric tpd
TCMP	877 metric tpd
Thermomechanical	2,100 metric tpd
Total	7,797 metric tpd
PAPER & BOARD	
Newsprint	3,399 metric tpd
Groundwood spec.	1,101 metric tpd
Printing/writing	363 metric tpd
Packaging/wrapper	62 metric tpd
Total	7,125 metric tpd

Allied Paper Inc.

2030 Portage St.
Kalamazoo, Mich. 49003
Ernest J. Klimczak, president/chief executive officer

(Subsidiary of SCM Corp.)

Net sales:	
1983	$315,900,000
1982	327,800,000
Operating income:	
1983	15,300,000
1982	33,300,000

Allied Paper had lower sales and substantially lower operating income in 1983 (ending June 30) due to the depressed market for both pulp and commodity papers, even though the Jackson mill had a small increase in output over 1982. Both Allied paper mills ran continuously throughout 1983 and posted improved profit margins in all grades at year-end.

Capital expenditures for fiscal-year 1983 were $12,400,000, with approximately $15,000,000 to be spent in 1984.

Production facilities:

JACKSON, ALA.
Pulp—600 tpd bleached kraft (about 50% for market)
Printing/writing paper—225 tpd

KALAMAZOO, MICH.
Printing/writing & specialty—300 tpd

Total production capacity:

PULP	600 tpd
PAPER	525 tpd

Appleton Papers Inc.

Box 359
Appleton, Wis. 54912
Thomas W. Busch, chairman/chief executive officer

(Subsidiary and paper division of BATUS Inc. of U.S., in turn a subsidiary of B.A.T. Industries of U.K.)

Net sales:	
1983	$465,325,000
1982	411,773,000
Operating income	
1983	80,454,000
1982	63,979,000

Capital expenditures at Appleton mills in 1983 were $29,039,000.

In mid-1984, Appleton agreed to acquire from P.H. Glatfelter Co. the 350-tpd recycled printing/writing paper mill at West Carrollton, Ohio. This would be Appleton's first recycling operation.

Production facilities:

WEST CARROLLTON, OHIO
(former P.H. Glatfelter mill)
Pulp—275 tpd bleached deinked
Fine papers—350 tpd

ROARING SPRING, PA.
Pulp—195 tpd bleached kraft
Carbonless paper—200 tpd

COMBINED LOCKS, WIS.
Pulp—200 tpd chemimechanical
Carbonless paper—450 tpd

Total production capacity:

PULP		
Kraft		195 tpd
Chemimechanical		200 tpd
Deinked		275 tpd
Total	670 tpd	
PAPER		
Carbonless		650 tpd
Fine (recycled)		350 tpd
Total	1,000 tpd	

Bato Co. Inc.

50 Chestnut St.
Byram, Conn. 06830
Murray Brant, chairman

(Wholly-owned subsidiary is F.F. Soucy Inc., which is a joint owner of F.F. Soucy Inc. et Associés along with Dow Jones and Rexfor; through its Brant-Allen Industries affiliate, Bato is a joint owner of Bear Island Paper along with Dow Jones and Washington Post)

Financial data not available.

Production facilities:

ASHLAND, VA.
(Bear Island Paper Co.)
Pulp—550 tpd thermomechanical
Newsprint—530 tpd

RIVIERE DU LOUP, QUE.
(F.F. Soucy Inc.)
Pulp—640 metric tpd thermomechanical
Newsprint—127 metric tpd

RIVIERE DU LOUP, QUE.
(F.F. Soucy Inc. et Associés)
Newsprint—454 metric tpd

Total production capacity:

PULP (short tons)	
Thermomechanical	1,250 tpd
PAPER (short tons)	
Newsprint	1,170 tpd

Boise Cascade Corp.

One Jefferson Sq.
Boise, Idaho 83728
John B. Fery, chairman/chief executive officer

(Boise owns Boise Cascade Canada and in spring-1984 acquired the 50% of Boise Southern Co. it did not already own)

Net sales:	
1983	$3,450,890,000
1982	2,912,450,000
Net income	
1983	60,380,000
1982	7,250,000

In late August 1984, Boise Cascade agreed to sell its 550-tpd market pulp mill at Newcastle, N.B., to Repap Enterprises Inc. of Montreal.

Boise pulp/paper/board facilities produced 2.44 million short tons at 14 mills in U.S. and Canada in 1983; an additional 567,000 tons were produced at joint-venture mills.

Sales of paper in 1983 were $1.2 billion, 33% of corporate total, but operating income of $114.5 million represented 55% of corporate total. Of the 2.28-million tons sold in 1983, printing/publishing papers accounted for 1.38-million tons; newsprint was 443,000 tons, and market pulp was 262,000 tons. Sales from Boise Southern joint venture were 566,000 tons of newsprint and kraft paper/board.

Paper Group capital expenditures (excluding working capital and leases) were $75.9-million during 1983.

Boise owns and/or controls 6.8-million acres of timberland in U.S. and Canada. An additional 905,000 acres are owned and/or controlled through joint ventures.

Production facilities:

White Paper Div.

INTERNATIONAL FALLS, MINN.
Pulp—370 tpd bleached kraft
Printing/publishing paper—545 tpd

RUMFORD, Maine
Pulp—790 tpd bleached kraft, 145 tpd groundwood, 150 tpd TMP
Printing/publishing paper—1,400 tpd

ST. HELENS, ORE.
Pulp—900 tpd bleached kraft (some to market)
Printing/publishing paper—615 tpd

VANCOUVER, WASH.
Printing/publishing paper—275 tpd

WALLULA, WASH.
Pulp—760 tpd bleached kraft (300 tpd to market), 180 tpd semichemical
Printing/publishing paper—475 tpd
Containerboard—300 tpd

Pulp, Publishing & Packaging Paper Div.

DeRIDDER, LA.
(Boise Southern)
Pulp—1,275 tpd unbleached kraft (some bleached), 305 tpd groundwood, 415 tpd TMP
Newsprint—930 tpd
Linerboard—965 tpd

STEILACOOM, WASH.
Pulp—450 tpd TMP
Newsprint—510 tpd

FORT FRANCES, ONT.
(Boise Cascade Canada)
Pulp—455 metric tpd (550 short) groundwood; 470 m tpd (520 short) bleached kraft (some for market)
Groundwood specialty papers—625 m tpd (690 short)

KENORA, ONT.
(Boise Cascade Canada)
Pulp—500 metric tpd (550 short) groundwood; 215 m tpd (235 short) sulfite
Newsprint—720 m tpd (795 short)

Specialty Paperboard Div.

SHELDON SPRINGS, VT.
Pulp—50 tpd groundwood
Specialty paperboard grades—150 tpd

BEAVER FALLS, N.Y.
(two mills)
Pulp—30 tpd refiner mechanical
Specialty paperboard grades—80 tpd

BROWNVILLE, N.Y.
Specialty paperboard grades—65 tpd

BRATTLEBORO, VT.
Specialty paperboard grades—90 tpd

Total production capacity:

PULP (air-dry short tons)	
Kraft	4,645 tpd
Groundwood	1,550 tpd
Thermomechanical	1,015 tpd
Refiner mechanical	480 tpd
Sulfite	235 tpd
Semichemical	180 tpd
Total	8,105 tpd

PAPER & BOARD (machine-dry short tons)	
Newsprint	2,235 tpd
Groundwood specialty	690 tpd
Printing/publishing	3,310 tpd
Containerboard	1,265 tpd
Specialty paperboard	385 tpd
Total	7,885 tpd

Bowater Inc.

1 Parkland Drive
Darien, Conn. 06820
A. P. Gammie, president/chief executive officer

Bowater Inc. is the new North American company formed in mid-1984 in a two-stage "demerger" operation that brought Bowater's three U.S. mills and the Liverpool, N.S., newsprint mill, plus converting plants, sawmills and retail stores, into a new corporate entity separated from the London-based Bowater Industries plc (new name for the British operations).

Net sales:*	
1983	$771,743,000
1982	796,959,000
Net earnings:*	
1983	37,976,000
1982	60,215,000

*Data from Bowater Inc. registration statement; results of Newfoundland operations not included.

In fall 1983, Bowater sold its Perkins Papers Ltd. mill and announced plans to sell (or close down by end-1984) the Corner Brook, Nfld., newsprint mill. In mid-1984 negotiations for a sale were underway.

The Bowater mills (excluding Newfoundland) produced 1,077,711 short tons of paper in 1983 and 244,674 tons of market pulp.

Capital spending in 1983 was $119,000,000, and $150,000,000 was scheduled for 1984. A major portion is targeted for the Calhoun mill where three boilers are being converted to burn coal, and four newsprint machines are getting top wire formers.

Bowater's timberlands include 844,000 acres owned and 218,000 acres controlled in U.S., and 755,000 acres owned in Canada.

Production facilities:
(short tons)

CATAWBA, S.C.
(Bowater Carolina Co.)
Pulp—1,150 tpd kraft (1,050 tpd bleached; 685 tpd for market), 110 tpd TMP, 150 tpd groundwood
Coated publication paper—350 tpd

CATAWBA, S.C.
(Catawba Newsprint Co., 51% owned by Bowater)
Pulp—500 tpd groundwood
Newsprint—635 tpd

CALHOUN, TENN.
(Bowater Southern Paper Co.)
Pulp—700 tpd semibleached kraft, 820 tpd groundwood, 240 tpd cold soda, 630 tpd thermomechanical
Newsprint & groundwood specialties—2,045 tpd

LIVERPOOL, N.S.
(Bowater Mersey Paper Co., 51% owned by Bowater)
Pulp—360 short tpd groundwood, 180 tpd TMP, 145 tpd sulfite
Newsprint—525 tpd

Total production capacity:

PULP (short tons)	
Cold soda	240 tpd
Kraft	1,850 tpd
Groundwood	1,830 tpd
Sulfite	145 tpd
Thermomechanical	920 tpd
Total	4,985 tpd

PAPER (short tons)	
Coated	350 tpd
Newsprint & groundwood specialties	3,205 tpd
Total	3,555 tpd

British Columbia Forest Products Ltd.

1050 W. Pender St.
Vancouver, B.C. V6E 2X3
Kenneth P. Benson, chairman/chief executive officer

(BCFP owns Blandin Paper Co. in U.S., 45% of Donohue St-Felicien Inc., 42.7% of Finlay Forest Products Industries Ltd.; 19% of Western Forest Products Ltd. Alberta Energy Co. Ltd. has an 18% interest in BCFP, Brunswick Pulp & Paper a 26% interest, and Mead Corp. 15%.)

Net sales (C$):	
1983	$899,676,000
1982	799,159,000
Net earnings (C$)	
1983	−32,744,000
1982	−60,961,000

Pulp and paper account for 70% of BCFP's sales, which rose substantially in 1983 vs. 1982. Operations continued to result in losses, though at a greatly diminished level, in 1983.

The recession in the forest industry during the past three years made it impossible for BCFP to finance the long-proposed $360,000,000 greenfield newsprint mill project in Alberta, and BCFP officially withdrew in early 1984.

Production at BCFP mills in 1983 included 338,000 metric tons of newsprint and groundwood specialty papers at Crofton and 276,000 short tons of coated groundwood grades at Blandin. Market pulp output in 1983 was 456,000 metric tons (from Crofton and BCFP's share of Donohue St-Felicien).

Capital spending in 1983 was $4,300,000; no budget for 1984 spending had been announced.

BCFP's timber sources include ownership of 131,000 acres in U.S. and 222,000 acres in Canada and cutting rights on 1,139,000 acres in Canada.

Production facilities:

GRAND RAPIDS, MINN.
(Blandin Paper Co.)
Pulp—180 air-dry short tpd thermomechanical; 175 tpd groundwood
Coated groundwood printing papers—875 short tpd

CROFTON, B.C.
(Crofton Pulp & Paper Div.)
Pulp—1,020 metric tpd kraft (for market), 540 tpd groundwood
Newsprint and specialty papers—1,260 metric tpd

MACKENZIE, B.C.
(Mackenzie Div.)
Pulp—560 metric tpd kraft (for market)

ST-FELICIEN, QUE.
(Donohue St-Felicien Inc.)
Pulp—800 metric tpd bleached kraft
(BCFP's share: 360 tpd)

Total production capacity:

PULP	
Kraft	1,940 metric tpd
Groundwood	698 metric tpd
Thermomechanical	163 metric tpd
Total	2,801 metric tpd

PAPER	
Newsprint/groundwood specialties	1,260 metric tpd
Coated groundwood	794 metric tpd
Total	3,054 metric tpd

CIP Inc.

1155 Metcalfe St.
Montreal, Que. H3B 2X1
C.S. Flenniken, president/chief executive office

(Former Canadian International Paper Co. was sold in 1981 to Canadian Pacific Enterprises Ltd. CP Enterprises also owns 54% of Great Lakes Forest Products. A one-third interest in CIP's New Brunswick mill is held by Oji Paper and Mitsui of Japan)

Financial data not available.

In early 1983, CIP bought out its partner's interest in Tahsis Co. and acquired complete control of the B.C. pulp and lumber producer.

Production facilities:

GOLD RIVER, B.C.
(Tahsis Co. Ltd.)
Pulp—680 metric tpd kraft (for market)

DALHOUSIE, N.B.
(NBIP Ltd.)
Pulp—600 metric tpd stone groundwood; 400 tpd New Process (SCMP) pulp; 200 tpd high-yield sulfite
Newsprint—1,000 metric tpd
Mill wrapper—30 metric tpd

HAWKESBURY, ONT.
Pulp—260 metric tpd sulfite (for market)
(shut down end-1982)

TORONTO, ONT.
(Dominion Cellulose Ltd.)
Tissue and towel—265 metric tpd

GATINEAU, QUE.
Pulp—450 metric tpd stone groundwood, 600 tpd refiner groundwood, 380 tpd New Process (SCMP) pulp
Newsprint—1,400 metric tpd

LA TUQUE, QUE.
Pulp—1,450 metric tpd kraft (460 tpd for market)
Kraft paperboard—697 metric tpd
Solid bleached board—283 metric tpd

MATANE, QUE.
Pulp—250 metric tpd semichemical
Semichemical corrugating medium—250 metric tpd

TROIS RIVIERES, QUE.
Pulp—240 metric tpd sulfite, 680 tpd groundwood
Groundwood specialties—900 metric tpd
Mill wrapper and core—30 metric tpd

Total production capacity:

PULP	
Kraft	2,130 metric tpd
Groundwood	1,730 metric tpd
New process (SCMP)	760 metric tpd
Refiner groundwood	600 metric tpd
Semichemical	250 metric tpd
Sulfite	440 metric tpd
Total	5,910 metric tpd

PAPER & BOARD	
Newsprint	2,400 metric tpd
Groundwood spec.	900 metric tpd
Wrapper	60 metric tpd
Tissue/towel	265 metric tpd
Solid bleached board	283 metric tpd
Unbleached board	697 metric tpd
Semichemical board	250 metric tpd
Total	4,855 metric tpd

Canfor Corp.

2800—1055 Dunsmuir St.
Vancouver, B.C. V7X 1B5
Peter J.G. Bentley, president/chief executive officer

In July 1983, Canfor Corp., previously a privately-owned holding company, made a common share issue and is now a publicly-owned company. Canadian Forest Products Ltd. and Prince George Pulp & Paper Ltd. are wholly owned subsidiaries. Intercontinental Pulp Co. is 75% owned.

Net sales (C$):	
1983	$995,100,000
1982	729,600,000
Net earnings (C$):	
1983	44,700,000
1982	−85,700,000

Approximately 30% of CanFor sales are from pulp and paper. Production in 1983 was 493,200 metric tons of kraft market pulp and 85,000 tons of kraft sack paper. All three mills achieved record average daily production rates in 1983: Howe Sound, 542 tons; Prince George P & P, 745 tons; Intercontinental Pulp, 646 tons.

Capital spending in 1983 was $22,600,000 for the company ($12,000,000 for pulp/paper). A major expansion/modernization program, announced in 1981 but suspended in 1982, has been revived for the Howe Sound pulp mill. It will increase output to 585 tpd by 1985.

Production facilities:

PORT MELLON, B.C.
(Howe Sound Pulp Div.)
Pulp—530 metric tpd bleached kraft (for market)

PRINCE GEORGE, B.C.
(Intercontinental Pulp Co.)
Pulp—645 metric tpd bleached and unbleached kraft (for market) (Canfor's 75%-share 484 tpd)

PRINCE GEORGE, B.C.
(Prince George Pulp & Paper)
Pulp—750 metric tpd bleached and unbleached kraft (450 tpd for market)
Sack paper—300 metric tpd

Total production capacity:

PULP	1,764 metric tpd
PAPER	300 metric tpd

Caraustar Industries Inc.

Washington St., Box 157
Austell, Ga. 30001
James G. Dalton, chairman/president

Financial data not available.

Caraustar is a holding company with 30 plants (mostly paper converting facilities) in about 10 states.

In mid-1984 Caraustar agreed to acquire three recycled paperboard mills from Container Corp. of America (at Chicago, Ill.; Cincinnati, Ohio; and Chattanooga, Tenn.)

Production facilities:

AUSTELL, GA.
(Austell Box Board Corp.)
Recycled paperboard—460 tpd

AUSTELL, GA.
(Sweetwater Paper Board Co.)
Recycled paperboard—380 tpd

CHICAGO, ILL.
(Chicago Paperboard Corp.)
Recycled paperboard—175 tpd

CHARLOTTE, N.C.
(Carolina Paper Board Corp.)
Recycled paperboard—160 tpd

CINCINNATI, OHIO
(Cincinnati Paperboard Corp.)
Recycled paperboard—170 tpd

TAYLORS, S.C.
(Caroteil Paper Board Corp.)
Recycled paperboard—200 tpd

CHATTANOOGA, TENN.
(Chattanooga Paperboard Corp.)
Recycled paperboard—130 tpd

Total production capacity:

PAPERBOARD	1,675 tpd

Cascades Inc.

P.O. Box 30
Kingsey-Falls, Que. J0A 1B0
Bernard Lemaire, president

Net sales (C$)	
1983	$62,033,000
1982	34,491,000
Net earnings (C$)	
1983	4,165,000
1982	2,526,000

Cascades bought its first paper mill in 1964, the closed-down Dominion Paper Ltd. mill in Kingsey-Falls. Over the intervening years, the company grew by acquiring other troubled, unprofitable mills and in 1983 and early 1984 added four mills that more than doubled both pulp- and papermaking capacity, and also brought the company its first papermaking facility outside Canada. Approximately 61% of 1983 sales were from pulp, paper/board and converted products.

Production at Cascades mills in 1983 totaled 196,800 metric tons of paper and board, and 22,000 tons of pulp.

Capital expenditures in 1983 were $11.8 million, and $17 million is planned for 1984, about 60% for pulp- and papermaking facilities.

Production facilities:

ROCKINGHAM, N.C.
(Cascades Industries Inc.)
Tissue—50 metric tpd

CABANO, QUE.
(Papier Cascades (Cabano) Inc.)
Pulp—225 metric tpd semichemical
Corrugating medium—300 metric tpd

EAST ANGUS, QUE.
(Cascades (East Angus) Inc.)
Pulp—180 metric tpd unbleached kraft
Kraft wrapping/bag paper—210 metric tpd
Folding boxboard—90 metric tpd

JONQUIERE, QUE.
(Cascades (Jonquiere) Inc.)
Pulp—200 metric tpd bleached/unbleached kraft, 100 tpd thermomechanical
Boxboard—180 metric tpd

KINGSEY-FALLS, QUE.
(Cascades Paper Inc.)
Corrugating medium—75 metric tpd
Molded pulp products—25 metric tpd

KINGSEY-FALLS, QUE.
(Les Industries Cascades Ltee.)
Tissue, toweling—130 metric tpd

KINGSEY-FALLS, QUE.
(Papier Kinsey-Falls)
Asbestos paper—140 metric tpd

BREAKEYVILLE, QUE.
(Desencrage Cascades Inc.)
(Former 70-tpd stone groundwood market pulp mill, dryer and other equipment to be utilized to produce 80 metric tpd deinked pulp—in operation in 1985)

Total production capacity:

PULP	
Kraft	380 metric tpd
Semichemical	225 metric tpd
Groundwood	100 metric tpd
Deinked	80 metric tpd
Total	785 metric tpd
PAPER & BOARD	
Tissue/toweling	180 metric tpd
Kraft packaging	210 metric tpd
Corrugating medium	375 metric tpd
Boxboard	270 metric tpd
Asbestos paper	140 metric tpd
Molded pulp	23 metric tpd
Total	1,200 metric tpd

Celotex Corp.

Box 22601
Tampa, Fla. 33622
Frank Burgen, president, Celotex

(Subsidiary of Jim Walter Corp.)

Celotex operates within the Mineral & Fiber Products Group of Jim Walter Corp., and is further divided into three operating units: Roofing Products, Building Products, and Industrial Products.

Sales of Mineral & Fiber Products group in fiscal 1983 (ended Aug. 31, 1983) were $620,908,000, 30% of corporate total. Contributions to income were $4,861,000 (compared to a $31,230,000 loss in fiscal 1982).

Celotex divested four asphalt roofing plants, in response to an FTC order. Roofing felt mills reported here have been further reduced by conversion to glass fiber from organic fiber, leaving Celotex in 1984 with only two organic fiber roofing felt mills.

Production facilities:

CAMDEN, ARK.
Roofing felt—35 tpd

QUINCY, ILL.
Gypsum board liner—300 tpd

DUBUQUE, IOWA
Pulp—250 tpd defibrated
Insulation board—250 tpd

MARRERO, LA.
Pulp—200 tpd bagasse
Insulation board—200 tpd

PERTH AMBOY, N.J.
Pulp—50 tpd defibrated
Roofing felt—100 tpd

SUNBURY, PA.
Pulp—90 tpd semichemical, 150 tpd defibrated
Building paper/board—240 tpd

Total production capacity:

PULP	
Bagasse	200 tpd
Defibrated	450 tpd
Semichemical	90 tpd
Total	740 tpd
CONSTRUCTION PAPER/BOARD	
Roofing felt	135 tpd
Gypsum board	300 tpd
Insulation board	450 tpd
Building paper/board	240 tpd
Total	1,125 tpd

Champion International Corp.

One Champion Plaza
Stamford, Conn. 06921
Andrew C. Sigler, chairman/chief executive officer
William R. Haselton, vice chariman

In early August 1984, Champion International offered to buy St. Regis Corp. for $1.8 billion, creating the nation's largest paper company and second-largest producer of lumber and plywood. The merger became effective November 1984.

Combined statement (pro forma, after adjustments, unaudited) of consolidated income of Champion and St. Regis shows:

Net sales:	
1983	$6,395,901,000
Net earnings:	
1983	74,745,000

Pre-merger report:
CHAMPION INTERNATIONAL

(Owns 73% of Weldwood of Canada, which in turn owns 50% of Cariboo Pulp & Paper)

Net sales:	
1983	$4,263,999,000
1982	3,737,378,000
Net earnings:	
1983	82,160,000
1980	39,650,000

Sales of Champion's Paper Div. in 1983 were $1,744,000,000 (41% of total); operating income was $158,000,000. Sales from Packaging Div. were $790,000,000 (18% of total); operations resulted in a loss of $4,000,000.

Production at Paper Div. mills in 1983 was 1,281,117 short tons of pulp and 1,437,017 tons of paper and paperboard. Output of Packaging Div. mills was 1,176,783 tons of pulp, 1,461,023 tons of paperboard and paper, 144,760 tons of folding cartons, 123,990 tons of bags and sacks, and 10,778,000,000 ft² of curugated containers.

Capital spending programs by Champion include the market pulp mill at Quinnesec, Mich., heading for 1986 operation and also a new bleached pulp and paper complex at Halifax, N.C., to be built toward the end of the 1980s. Spending for capital projects in 1983 was $178,093,000.

No. 34 paper machine started up in 1983 at Courtland, Ala., three months ahead of schedule and $40 million under original budget. A 3-year $29-million capital program began at the Pasadena, Texas, pulp/paper mill in 1983.

Champion's timberland holdings in U.S. total 3,381,055 acres (3,027,350 acres owned; 353,705 acres controlled); and in Canada are 573,400 acres (58,400 acres owned; 515,000 acres controlled.)

Pre-merger report: ST. REGIS CORP.

Net sales:	
1983	$2,774,578,000
1982	2,555,949,000
Net earnings:	
1983	55,181,000
1982	45,028,000

In 1982, St. Regis acquired the Hennepin Paper mill in Little Falls, Minn.; in 1983 it closed the recycled board mill in Coshocton, Ohio, and sold the kraft pulp/paper mill in Jacksonville, Fla. In spring of 1984 it sold the big kraft pulp/paper/board mill in Monticello, Miss., to Georgia-Pacific and also sold the Fountain St. recycled board mill in Battle Creek, Mich.

Sales of Kraft & Recycled Fiber Products (includes market pulp) were $713 million in 1983 (includes intersegment sales). Pulp production was 2,880,000 tons (of which 144,000 tons were sold). Kraft linerboard output was 739,000 tons, kraft papers 584,000 tons, recycled paperboard 187,000 tons, recycled medium 252,00 tons.

Printing Paper sales in 1983 (including intersegment) were $625 million; printing paper production was 901,000 tons. Newsprint sales were $298 million; production was 735,000 tons.

Packaging and specialty paper production in 1983 was 66,000 tons; sales of these grades are included in the $905-million revenues of the Packaging and Converted business segment.

St. Regis owns 3,183,000 acres of timberland and contract rights on 2,657,000 acres in U.S. and Canada.

Merged production facilities:

COURTLAND, ALA.
(Paper Division)
Pulp—1,393 tpd kraft (275 tpd for market)
Uncoated and coated printing, writing and converting papers—1,150 tpd

PENSACOLA, FLA.
(St. Regis Kraft Div.)
Pulp—1,560 tpd kraft (unbleached 1,275 tpd; bleached 285 tpd)
Industrial converting paper—1,340 tpd

BUCKSPORT, MAINE
(St. Regis Printing Paper Div.)
Pulp—300 tpd groundwood, 146 tpd thermomechanical
Printing/writing paper—1,160 tpd

BATTLE CREEK, MICH.
(St. Regis Recycled Fiber Div.)
Combination (recycled) board—300 tpd

LITTLE FALLS, MINN.
(St. Regis/Hennepin Paper Co.)
Pulp—82 tpd groundwood
Groundwood specialties—80 tpd

ONTONAGON, MICH.
(Packaging Division)
Pulp—500 tpd semichemical
Corrugating medium—750 tpd

QUINNESEC, MICH.
Pulp—750 bleached hardwood kraft (Market pulp mill under construction, for late 1986 startup)

ST. PAUL, MINN.
(Packaging Division)
Recycled medium—310 tpd
Combination (recycled) board—360 tpd

SARTELL, MINN.
(St. Regis Printing Paper Div.)
Pulp—140 tpd groundwood; 400 tpd thermomechanical
Printing/writing paper—720 tpd (coated 480 tpd; uncoated 240 tpd)

MISSOULA, MONT.
(Packaging Division)
Pulp—1,900 tpd unbleached kraft
Linerboard—1,850 tpd unbleached

DEFERIET, N.Y.
(St. Regis Printing Paper Div.)
Pulp—320 tpd groundwood
Printing/writing paper—620 tpd (coated and uncoated)

CANTON, N.C.
(Paper Division)
Pulp—1,440 tpd bleached kraft
Uncoated printing/writing and converting papers—900 tpd; bleached paperboard—705 tpd

ROANOKE RAPIDS, N.C.
(Packaging Division)
Pulp—1,100 tpd unbleached kraft
Unbleached kraft paper—450 tpd (also swings to linerboard output)
Unbleached linerboard—650 tpd

COLUMBUS, OHIO
(St. Regis Printing Paper Div.)
Specailty packaging paper—44 tpd

COSHOCTON, OHIO
(St. Regis Recycled Fiber Div.)
(Mill idled in 1983)

HAMILTON, OHIO
(Paper Division)
Uncoated and coated printing, writing & converting papers—495 tpd

YORK, PA.
(St. Regis Recycled Fiber Div.)
Combination (recycled) board—350 tpd

HOUSTON, TEXAS
(St. Regis Newsprint Div.)
Pulp—650 tpd kraft (unbleached 300 tpd, bleached 350 tpd), 800 tpd groundwood, 400 tpd thermomechanical
Newsprint—1,325 tpd

LUFKIN, TEXAS
(St. Regis Newsprint Div.)
Pulp—400 tpd unbleached kraft, 360 tpd semibleached kraft, 830 tpd groundwood
Newsprint—980 tpd
Directory paper—125 tpd

PASADENA, TEXAS
(Paper Division)
Pulp—750 tpd bleached kraft (some for market)
Uncoated and coated printing/writing and converting papers—710 tpd

TACOMA, WASH.
(St. Regis Kraft Div.)
Pulp—1,040 tpd kraft (unbleached 820 tpd, bleached 220 tpd) (some for market)
Industrial converting paper—290 tpd
Unbleached kraft & solid bleached board—485 tpd

HINTON, ALTA.
(St. Regis (Alberta) Ltd.)
Pulp—513 metric tpd kraft (590 short for market)

QUESNEL, B.C.
(Cariboo Pulp & Paper Co., joint venture)
Pulp—680 metric tpd (750 short) bleached kraft; Champion's share is 248 metric (273 short) tpd

Total merged production capacity:

PULP (short tons)	
Kraft*	11,456 tpd
Semichemical	500 tpd
Groundwood	2,472 tpd
Thermomechanical	946 tpd
Total	15,734 tpd
PAPER	
Newsprint	2,305 tpd
Printing/writing free-sheet	3,255 tpd
Printing/writing gwd	2,705 tpd
Kraft paper	450 tpd
Packaging specialty	44 tpd
Industrial converting	1,630 tpd
Total	10,389 tpd
BOARD	
Linerboard	2,500 tpd
Corrugating medium	750 tpd
Kraft board (bl & unbl)	485 tpd
Bleached board	705 tpd
Recycled board	1,120 tpd
Total	5,760 tpd

*Does not include Quinnesec capacity

Chesapeake Corp.

West Point, Va. 23181
J. Carter Fox, president/chief executive officer

Net sales:	
1983	$273,800,000
1982	239,900,000
Net earnings:	
1983	12,500,000*
1982	8,100,000

*Extraordinary charge

Pulp/paper and converted products accounted for 85% of Chesapeake's sales in 1983; wood products accounted for 15% of sales. Production of pulp and paper in 1983 totaled 493,000 tons; shipments totaled 508,000 tons (253,000 tons kraft paperboard; 123,000 tons kraft paper; 132,000 tons bleached kraft market pulp).

A major expansion now underway at the West Point mill includes a new 900-tpd paperboard machine, due for startup in late 1985, bringing mill annual capacity to 645,00 tons.

Chesapeake owns 376,000 acres of timberland in four states. During 1983, 42% of wood requirements came from company land and short-term cutting rights, and 58% was purchased.

Production facilities:

WEST POINT, VA.
Pulp—1,300 tpd softwood and hardwood kraft (475 tpd bleached for market)
Paper—450 tpd
Paperboard—700 tpd

Total production capacity:

PULP	1,300 tpd
PAPER & BOARD	1,150 tpd

Consolidated-Bathurst Inc.

800 Dorchester Blvd.
W. Montreal, Que. H3B 1Y9
William I. M. Turner Jr., president/chief executive officer

(Owned 40% by Power Corp. of Canada)

Net sales (C$):	
1983	$1,393,065,000
1982	1,424,284,000
Net earnings (C$):	
1983	33,331,000*
1982	53,406,000

*Extraordinary items

The above figures are corporate sales and earnings; 1983 earnings were $43,000,000 before the extraordinary charge. Net sales of the Pulp & Paper Group in 1983 were $692,100,000, including $35,000,000 to company packaging operations; this is 1.3% below 1982 because a 2% increase in sales volume was more than offset by lower average prices.

Production at Con-Bath mills in 1983 was 1,149,690 metric tons of paper and board, and 208,150 tons of market pulp.

Shipments of newsprint and groundwood specialty grades were 840,000 tons in 1983, a modest 2% rise over 1982 shipments. Market pulp shipments of 200,000 tons were 12% above the 1982 level. Shipments of containerboard were 252,000 tons, down 7% from 1982; kraft paper and board shipments, at 56,000 tons, were up 2%.

Capital expenditures in 1983 for Pulp & Paper Group projects were $121,064,000. Spending in 1984 was expected to be $89,950,000. The key project was the Bathurst/Bridgewater development. A new chemi-thermomechanical pulp mill at Bathurst, N.B., came online in mid-1983, to supply fiber for the Bridgewater newsprint mill in U.K. (acquired in 1981 from Bowater).

Con-Bath owns 43,225 acres of timberland in Canada, with control over an additional 16,624,214 acres, plus guaranteed wood volume agreements with two provinces, totaling 1,200,000 m^3 of wood annually.

Production facilities:

BATHURST, N.B.
Pulp—440 metric tpd chemi-thermomechanical pulp (primarily for Bridgewater mill in U.K.); 291 tpd semichemical
Corrugating medium—340 metric tpd

GRAND'MERE, QUE.
(Laurentide Div.)
Pulp—400 metric tpd groundwood, 200 tpd very-high-yield sulfite
Groundwood specialties—526 metric tpd
Paperboard—100 metric tpd

NEW RICHMOND, QUE.
(Chaleurs Div.)
Pulp—614 metric tpd unbleached kraft
Linerboard—590 metric tpd

PORTAGE-DU-FORT, QUE.
(Pontiac Div.)
Pulp—583 metric tpd bleached kraft (for market)

SHAWINIGAN, QUE.
(Belgo Div.)
Pulp—865 metric tpd groundwood, 285 tpd high-yield sulfite
Newsprint—862 metric tpd

TROIS-RIVIERES, QUE.
(Wayagamack Div.)
Pulp—265 metric tpd unbleached and semibleached kraft, 362 tpd groundwood
Groundwood specialties—435 metric tpd
Kraft paper—124 metric tpd

VILLE DE LA BAIE, QUE.
(Port Alfred Div.)
Pulp—424 metric tpd groundwood, 235 tpd high-yield sulfite, 224 tpd TMP
Newsprint—879 metric tpd

Total production capacity:

PULP	
Kraft	1,462 metric tpd
Semichemical	291 metric tpd
Groundwood	2,051 metric tpd
Thermomechanical	224 metric tpd
CTMP	440 metric tpd
Very-high-yield sulfite	200 metric tpd
High-yield sulfite	520 metric tpd
Total	5,188 metric tpd
PAPER	
Newsprint	1,741 metric tpd
Groundwood spec	961 metric tpd
Linerboard	590 metric tpd
Corrugating medium	340 metric tpd
Kraft paper	124 metric tpd
Paperboard	100 metric tpd
Total	3,856 metric tpd

Consolidated Papers Inc.

Box 50
Wisconsin Rapids, Wis. 54494
George W. Mead, chairman/chief executive officer

Net sales:	
1983	$573,346,482
1982	530,295,810
Net earnings:	
1983	48,974,593
1982	40,002,781

Sales in 1983 reached a new high for Consolidated, and earnings were a comfortable increase over 1982. Sales of pulp, paper/board and converted products comprised 88% of Consolidated's total in 1983.

Shipments of 681,786 tons of pulp and paper in 1983 were also an all-time high. Enamel papers accounted for 567,068 tons, with specialty papers at 52,432 tons, and paperboard at 2,705 tons. No market pulp was sold in 1983. Paperboard products and corrugated containers accounted for 59,581 tons.

Production in 1983 at Consolidated's five mills was 743,742 tons of paper/board and 295,920 tons of pulp.

Capital spending in 1983 was $42,109,000 and $59,064,000 is budgeted for 1984 (91% for pulp/papermaking facilities). Three major projects are a second digester and other improvements at the Kraft Div. pulp mill; a major rebuild of No. 12 enamel paper machine at Rapids Div.; and a new shipping department at Biron Div. (all three mills at Wisconsin Rapids).

Consolidated's timberland holdings are comprised of 315,233 acres owned in the U.S. and 358,483 acres owned in Canada, with an additional 4[illegible]3,391 acres of controlled lands in Canada.

Production facilities:

STEVENS POINT, WIS.
(Stevens Point Div.)
Specialty papers—136 tpd

STEVENS POINT, WIS.
(Wisconsin River Div.)
Pulp—256 tpd groundwood
Book papers—580 tpd

WISCONSIN RAPIDS, WIS.
(Wisconsin Rapids Div.)
Enamel papers—543 tpd
Paperboard—96 tpd

WISCONSIN RAPIDS, WIS.
(Biron Div.)
Pulp—308 tpd groundwood
Book papers—614 tpd

WISCONSIN RAPIDS, WIS.
(Kraft Div.)
Pulp—577 tpd kraft

Total production capacity:

PULP		
Groundwood		564 tpd
Kraft		577 tpd
Total	1,141 tpd	
PAPER & BOARD		
Book papers		1,737 tpd
Specialty papers		136 tpd
Paperboard		96 tpd
Total	1,969 tpd	

Container Corp. of America

One First National Plaza
Chicago, Ill. 60603
Robert O. Swanson, president/chief executive officer

(Subsidiary of Mobil Corp.)

Net sales:	
1983	$1,779,000,000
1982	1,953,000,000
Operating earnings:	
1983	1,000,000
1982	24,000,000

Paperboard and converted products sales accounted for 94% of CCA's total in 1983.

Production of paperboard at CCA mills in 1983 totaled 2,312,000 tons. Capital spending at mills and converting facilities in 1983 was $129 million.

In mid-1984, CCA agreed to sell three recycled board mills with total of 475 tpd capacity (at Chicago, Ill.; Cincinnati, Ohio and Chattanooga, Tenn.). Purchaser was Caraustar Inc., of Austell, Ga. Earlier in 1984, CCA withdrew from its project to acquire and renovate the 1,000-tpd Eden mill at Whippany, N.J., citing delays in getting permits and local opposition as deterrents.

CCA's timberland holdings comprise 1,006,000 acres in U.S.

Production facilities:

BREWTON, ALA.
Pulp—1,200 tpd kraft
Unbleached kraft board—675 tpd
Solid bleached board—475 tpd

SANTA CLARA, CALIF.
Combination (recycled) board—270 tpd

VERNON, CALIF.
Combination (recycled) board—400 tpd

FERNANDINA BEACH, FLA.
Pulp—1,400 tpd kraft, 300 tpd semichemical
Unbleached kraft board—1,450 tpd
Semichemical corrugating medium—350 tpd

CARTHAGE, IND.
Combination (recycled) board—100 tpd

WABASH, IND.
Combination (recycled) board—320 tpd

CIRCLEVILLE, OHIO
Pulp—200 tpd semichemical
Semichemical corrugating medium—300 tpd

PHILADELPHIA, PA.
Combination (recycled) board—475 tpd

TACOMA, WASH.
Combination (recycled) board—65 tpd

Total production capacity:

PULP		
Kraft		2,600 tpd
Semichemical		500 tpd
Total	3,100 tpd	
PAPERBOARD		
Unbleached kraft		2,210 tpd
Solid bleached		475 tpd
Semichemical corrugating medium		650 tpd
Combination (recycled)		1,545 tpd
Total	4,880 tpd	

Continental Forest Industries Inc.

21 Harbor Plaza
Stamford, Conn. 06904
Francis C. Oatway, president

(CFI is a wholly-owned subsidiary of Continental Group Inc.)

Net sales:	
1983	$517,000,000
1982	466,000,000
Operating earnings:	
1983	41,000,000
1982	41,000,000

In late 1983 Continental sold its Brown System operations—three unbleached pulp and paper mills (Port Wentworth, Ga.; Hodge, La.; and Hopewell, Va.) and 20 container plants. Purchaser was Stone Container Corp. The sales and earnings data shown above do not include operations of the Brown System.

CFI facilities now include the Augusta bleached paperboard mill, sawmills and a timberland base of 1.4-million acres, all in the U.S. South.

Production in 1983 at the Augusta facility was 387,000 tons of paperboard and 33,000 tons of market pulp.

Production facilities:

AUGUSTA, GA.
(Bleached System)
Pulp—800 tpd bleached kraft (some for market), 400 tpd thermomechanical
Bleached paperboard—1,075 tpd

Total production capacity:

PULP		
Kraft		800 tpd
Thermomechanical		400 tpd
Total	1,200 tpd	
PAPER & BOARD		1,075 tpd

Crown Forest Industries Ltd.

700—815 West Hastings St
Vancouver, B.C. V6C 2Y4
J. L. Christensen, vice president, Pulp & Paper Group

In 1983, the former Crown Zellerbach Canada Ltd. was acquired 96% by Fletcher Challenge Ltd. of New Zealand, and its name was changed to Crown Forest Industries Ltd.

Net sales (C$)	
1983	$727,300,000
1982	654,700,000
Net earnings (C$)	
1983	−33,000,000
1982	−46,700,000

Pulp and paper sales in 1983, at $309,500,000, accounted for 45% of Crown Forest's total. Operating earnings of $34,700,000 for the Pulp & Paper Group were counterbalanced by a loss of $31,300,000 in the wood products sector.

Production in 1983 at the Campbell River mill resulted in 334,000 metric tons of newsprint, 85,000 tons of kraft paper and 174,000 tons of bleached kraft market pulp. This was a substantial increase over 1982 production; the early-1982 startup and smooth operation of CF's new No. 5 newsprint machine was a major contributor to higher output.

Capital spending in 1983 was $6,500,000, and $10,800,000 was to be spent in 1984 on pulp and papermaking operations.

CF owns 320,000 acres and has cutting right on 984,000 acres, in B.C.

Production facilities:

CAMPBELL RIVER, B.C.
Pulp—1,036 metric tpd kraft (590 tpd bleached for market), 1,250 tpd thermomechanical
Paper—1,130 metric tpd newsprint, 240 tpd kraft specialties and linerboard

Total production capacity:

PULP	
Kraft (bleached & unbleached)	1,036 metric tpd
Thermomechanical	1,250 metric tpd
Total	2,286 metric tpd
PAPER & BOARD	
Newsprint	1,130 metric tpd
Kraft specialties/linerboard	240 metric tpd
Total	1,370 metric tpd

Crown Zellerbach

One Bush St.
San Francisco, Calif. 94104
W. T. Creson, chairman/president/chief executive officer

Net sales:	
1983	$2,708,600,000
1982	2,947,400,000*
Net income:	
1983	87,800,000
1982	−112,200,000*

*Includes Crown Zellerbach Canada Ltd. and Norsk Pacific Steamship Co., sold Dec. 1982

In early 1982, Crown Zellerbach disclosed a program focused on six "core" mills which would be upgraded in a multiyear $2.1-billion spending program and indicated that some other "secondary" facilities would be sold. By end-1982, CZ had sold its 84% interest in Crown Zellerbach Canada to Fletcher Challenge Ltd. of New Zealand, and had sold its 50% interest in the Crown Simpson Pulp mill at Fairhaven, Calif., to its partner Simpson Paper Co. Ownership of the 425-tpd unbleached kraft pulp/paper mill at Port Townsend, Wash., passed to Haindl Papier GmbH of Fed. Rep. Germany in Dec. 1983.

Included in the modernization programs at CZ's "core" mills is the new 450-tpd paper machine at Camas, Wash., and rebuilds of two machines at St. Francisville, La. A new tissue machine to be installed at South Glens Falls, N.Y., is part of a $300-million program to increase towel and tissue capacity by over 50%.

Production at Crown Z mills in 1983 included 126,000 tons of newsprint, 437,000 tons of other printing papers, 596,000 tons of business and converting grades, 331,000 tons of tissue and sanitary papers, 565,000 tons of containerboard. Market pulp output was 41,000 tons.

CZ owns 1,665,000 acres of managed forests in U.S., and controls 311,000 acres.

Production facilities:

ANTIOCH, CALIF.
Recycled paperboard—590 tpd
(Tissue mill idled in 1980)

LOS ANGELES, CALIF.
Tissue and towel—71 tpd
(Mill to be closed end 1984)

BOGALUSA, LA.
Pulp—1,300 tpd unbleached kraft, 300 tpd semichemical
Containerboard—1,200 tpd

ST. FRANCISVILLE, LA.
Pulp—500 tpd kraft, 240 tpd groundwood
Coated groundwood specialties—500 tpd
Kraft specialties—300 tpd

CARTHAGE, N.Y.
Pulp—40 tpd deinked
Tissue and towel—135 tpd

SOUTH GLENS FALLS, N.Y.
Pulp—80 tpd deinked
Tissue and towel—125 tpd

BALTIMORE, OHIO
Recycled paperboard—173 tpd

CLATSKANIE, ORE.
(Wauna Div.)
Pulp—800 tpd bleached kraft (200 tpd for market), 300 tpd groundwood
Newsprint—400 tpd
Tissue—270 tpd
Industrial paper—220 tpd

LEBANON, ORE.
(Containerboard mill idled in 1980)

WEST LINN, ORE.
Pulp—150 tpd groundwood
Newsprint, groundwood printing, toweling, kraft papers—480 tpd

CAMAS, WASH.
Pulp—810 tpd bleached kraft, 490 tpd magnefite
Communication papers—450 tpd
Tissue, towel—340 tpd
Bleached kraft papers—280 tpd

PORT ANGELES, WASH.
Pulp—302 tpd groundwood
Newsprint, groundwood printing—425 tpd

Total production capacity:

PULP	
Kraft	3,410 tpd
Sulfite (magnefite)	490 tpd
Semichemical	300 tpd
Groundwood	992 tpd
Deinked	120 tpd
Total	5,312 tpd
PAPER & BOARD	
Tissue/toweling	1,062 tpd
Groundwood specialties	745 tpd
Newsprint	820 tpd
Communication papers	450 tpd
Kraft/industrial specialties	920 tpd
Containerboard	1,200 tpd
Recycled paperboard	763 tpd
Total	5,960 tpd

Domtar Inc.

395 de Maisonneuve Blvd. W.
Montreal, Que. H3A 1L6
James H. Smith, president/chief executive officer

Net sales (C$):	
1983	$1,820,000,000
1982	1,687,000,000
Net earnings (C$):	
1983	40,200,000*
1982	−1,600,000

*Extraordinary charge

(More than 45% of Domtar is jointly owned by Caisse de dépôt et placement du Québec, and Soc. Générale de Financement du Québec.)

Domtar's sales of fine papers increased 6% in 1983 to C$492,000,000, while operating profit increased 32% to $46,000,000. Sales of other pulp and paper products were marginally lower than in 1982, while operating profit of $5,000,000 decreased from $9,000,000 in 1982. Total pulp and paper sales in 1983 were $858,400,000, representing 47% of corporate total.

Paper production in 1983 included 359,139 metric tons of newsprint and groundwood specialties; 328,524 tons of fine and specialty paper; 301,614 tons of containerboard; 99,769 tons of kraft paper and boxboard. Market pulp output was 168,794 tons.

Capital spending in 1983 was $108,000,000, and $150,000,000 was expected to be spent in 1984 (excluding any outlays for the Windsor, Que., mill project—$773,000,000 in 1984-89 period). The Windsor facility is to be converted into a world-scale fine paper complex by 1989, while the 658-m-tpd mill at Cornwall, Ont. (Domtar's largest fine paper mill) is getting a $139,000,000 upgrade targeted for 1988 completion.

In fall 1983, Domtar sold its 375-tpd East Angus, Que. kraft paper/boxboard mill to Cascades Inc. In January 1984, Domtar agreed to acquire the 170-tpd construction board mill to Upson Co. at Lockport, N.Y.

Domtar's timberlands comprise 897,000 acres owned and 9,760,000 acres controlled.

Production facilities:

Construction Materials Group:

THOROLD, ONT.
(Roofing & Fiberboard Products)
Pulp—60 metric tpd woodflour
Roofing felt—64 metric tpd

DONNACONA, QUE.
(Roofing & Fiberboard Products)
Insulation board ½ in.—400,000 ft²/day (est. 127 metric tpd)

SAN LEANDRO, CALIF.
(Domtar Gypsum America)
Chipboard, gypsum linerboard—150 short tpd

LOCKPORT, N.Y.
(Former Upson Co. mill)
Construction board—170 short tpd

Pulp & Paper Group:

CORNWALL, ONT.
(Fine Papers Div.)
Pulp—408 metric tpd kraft
Fine papers—658 metric tpd

ST. CATHARINES, ONT.
(Fine Papers Div.)
Fine papers—180 metric tpd

DON VALLEY, ONT.
(Fine Papers Div.)
Fine papers—35 metric tpd

BEAUHARNOIS, QUE.
(Fine Papers Div.)
Fine papers—50 metric tpd

WINDSOR, QUE.
(Fine Papers Div.)
Pulp—390 metric tpd kraft (100 tpd for market)
Fine papers—191 metric tpd
Kraft papers—68 metric tpd

DOLBEAU, QUE.
(Newsprint & Kraft Div.)
Pulp—145 metric tpd sulfite, 318 tpd groundwood
Newsprint—530 metric tpd

DONNACONA, QUE.
(Newsprint & Kraft Div.)
Pulp—80 metric tpd sulfite, 500 tpd thermomechanical
Newsprint—122 metric tpd
Groundwood printing—363 metric tpd

LEBEL-SUR-QUEVILLON, QUE.
(Newsprint & Kraft Div.)
Pulp—720 metric tpd kraft (for market)

Packaging Group:

MISSISSAUGA, ONT.
(Containerboard Div.)
Linerboard—227 metric tpd

RED ROCK, ONT.
(Containerboard Div.)
Pulp—667 metric tpd kraft, 163 tpd groundwood
Linerboard—608 metric tpd
Newsprint—191 metric tpd

TRENTON, ONT.
(Containerboard Div.)
Pulp—136 metric tpd semichemical
Corrugating medium—172 metric tpd

Total production capacity:

PULP	
Kraft	2,185 metric tpd
Sulfite	225 metric tpd
Groundwood	481 metric tpd
Semichemical	136 metric tpd
TMP	500 metric tpd
Total	3,527 metric tpd
PAPER & BOARD	
Newsprint	833 metric tpd
Fine papers	1,114 metric tpd
Kraft papers	68 metric tpd
Groundwood spec.	363 metric tpd
Linerboard	835 metric tpd
Corrugating medium	172 metric tpd
Construction board	154 metric tpd
Gypsum paper	136 metric tpd
Total	3,675 metric tpd
BUILDING BOARD	
Roofing felt	64 metric tpd
Insulation board	127 metric tpd
Total	191 metric tpd

Donohue Inc.

1150 Claire-Fontaine
Quebec City, Que. G1R 5G4
Edward P. Walsh, president/chief executive officer

(Owns 55% of Donohue Charlevoix Inc., 65% of Donohue Malbaie Inc., 55% of Donohue St-Felicien Inc. and 58% of Donohue Normick Inc. Soc. Générale de Financement du Québec, a Québec government agency, owns 56% of Donohue.)

Net sales (C$):	
1983	$357,342,000
1982	315,296,000
Net earnings (C$):	
1983	9,374,000
1982	16,463,000

Consolidated net sales for Donohue reached a record level in 1983, an increase attributable to higher shipments of newsprint and lumber. Output of newsprint in 1983 was 368,713 metric tons; market pulp production was 282,693 tons.

A modernization program at the Clermont mill includes conversion in 1984 of No. 1 machine to production of groundwood specialties and an upgrade on No. 4 machine, and a C$120-million 720-m-tpd thermomechanical pulp mill scheduled for mid-1985 startup.

Production facilities:

AMOS, QUE.
(Donohue Normick Inc.)
Pulp—480 metric tpd thermomechanical
Newsprint—453 metric tpd

CLERMONT, QUE.
Pulp—136 metric tpd sulfite, 545 tpd groundwood
Newsprint/groundwood specialties—710 metric tpd (256 tpd for Donohue; 340 tpd Donohue Charlevoix Inc.; 114 tpd Donohue Malbaie Inc.)

ST-FELICIEN, QUE.
(Donohue St-Felicien)
Pulp—798 metric tpd bleached kraft for market (Donohue's share—436 tpd)

Total production capacity:

PULP	
Sulfite	136 metric tpd
Groundwood	545 metric tpd
TMP	480 metric tpd
Kraft	436 metric tpd
Total	1,597 metric tpd
PAPER	
Newsprint & groundwood specialties	1,163 metric tpd

Eddy Paper Co. Ltd.

1335 Carling Ave.
Ottawa, Ont. K1Y 4L5
J.C. Scarth, president/chief executive officer

(Wholly-owned subsidiary of George Weston Ltd., Eddy Paper in turn owns E.B. Eddy Forest Products Ltd. and Eastern Fine Paper Inc.)

Net sales (C$):	
1983	$429,971,000
1982	377,499,000

Earnings data are not available. About 91% of 1983 sales were derived from pulp, paper and converted products.

Production of paper in 1983 was 268,672 metric tons; pulp output was 233,530 tons.

Capital expenditures in 1983 were C$83,245,000, primarily on the pulp mill upgrade at Espanola, Ont. About $47,500,000 was to be spent in 1984.

Eddy owns 6,400 acres of woodlands in Canada, and has control of an additional 6,400 acres.

Production facilities:

ESPANOLA, ONT.
(E.B. Eddy Forest Products)
Pulp—830 metric tpd kraft (430 tpd for market)
Specialty papers—108 metric tpd

OTTAWA, ONT.
(E.B. Eddy Forest Products)
Fine & specialty papers—168 metric tpd

HULL, QUE.
(E.B. Eddy Forest Products)
Tissue—222 metric tpd
Fine & specialty papers—240 metric tpd

BREWER, MAINE
(Eastern Fine Paper Inc.)
Printing, writing & related papers—154 metric tpd (170 short tpd)

Total production capacity:

PULP	830 metric tpd
PAPER	
Fine/specialty papers	670 metric tpd
Tissue	222 metric tpd
Total	892 metric tpd

Eurocan Pulp & Paper Ltd.

1176 W. Georgia St., No. 1600
Vancouver, B.C. V6E 4A2
Kari Suoparki, president/chief executive officer
(Eurocan is owned 60% by Enso-Gutzeit Oy of Finland and 40% by West Fraser Timber Co. of B.C.)

Net sales (C$):	
1983	$181,000,000
1982	149,000,000

Other financial data are not available. Pulp and paper/board products account for 65% of total sales.

Production of paper and paperboard in 1983 was 317,000 metric tons.

Capital expenditures were $7,000,000 in 1983 and were expected to be $10,000,000 in 1984.

Eurocan has cutting rights on 2,500,000 acres of timberland.

Production facilities:

KITIMAT, B.C.
Pulp—950 b.d. metric tpd kraft (some for market)
Linerboard and kraft paper—1,010 metric tpd

Total production capacity:

PULP	950 metric tpd
PAPER & BOARD	1,010 metric tpd

Federal Paper Board Co. Inc.

75 Chestnut Ridge Rd.
Montvale, N.J. 07645
John R. Kennedy Jr., president/chief executive officer

Net sales:	
1983	$568,999,000
1982	509,987,000
Net earnings:	
1983	12,458,000
1982	16,065,000

Pulp, paperboard and converted products comprised 92% of Federal's 1983 sales. Sales of bleached paperboard and pulp totaled $305,234,000, recycled paperboard was $90,947,000, folding carton sales were $173,869,000 (figures include outside customers and intersegment sales). Net sales of bleached board to unaffiliated customers were $186,307,000, pulp sales were $102,908,000.

Federal's production in 1983 of bleached board was 330,000 tons, and market pulp output reached 367,000 tons. Recycled paperboard output was 273,000 tons.

Capital spending in 1983 was $30,666,000, and is targeted to be $42,000,000 in 1984.

Federal owns 270,000 acres in timberland in U.S., and controls an additional 116,000 acres.

Production facilities:

CITY OF COMMERCE, CALIF.
Combination paperboard—158 tpd

VERSAILLES, CONN.
(Sprague Div.)
Combination paperboard—465 tpd

RIEGELWOOD, N.C.
Pulp—2,000 tpd bleached kraft (1,040 tpd for market)
Bleached paperboard—960 tpd

RICHMOND, VA.
Combination paperboard—226 tpd

Total production capacity:

PULP	2,000 tpd
PAPERBOARD	
Bleached paperboard	960 tpd
Recycled paperboard	849 tpd
Total	1,890 tpd

Fort Howard Paper Co.

1919 S. Broadway
Green Bay, Wis. 54304
Paul J. Schierl, chairman/chief executive officer

Net sales:	
1983	$785,976,000
1982	537,030,000
Net earnings:	
1983	106,980,000
1982	92,400,000

In mid-1983, Fort Howard acquired Maryland Cup Corp., a major producer of disposable food containers. Fort Howard's sales are expected to more than double on an annual basis; the 46.4% increase in 1983 sales reflects the Maryland Cup contribution for four months.

Sales of paper and converted products account for 95% of Fort Howard's total sales. In 1983, sanitary tissue products were 68% and disposable food/beverage products 27%.

Major capital spending programs are underway at both Fort Howard mills, with a new tissue machine scheduled for each mill—No. 10 at Green Bay to start in late 1984, No. 4 at Muskogee set for early-1986 startup. Company-wide expenditures in 1983 were $92,000,000; for 1984, the figure is expected to be $130,000,000.

Production facilities:

(Fort Howard does not release capacity data; figures below are F&P estimates)

MUSKOGEE, OKLA.
Pulp—775 tpd deinked
Tissue, toweling, napkin grades—800 tpd

GREEN BAY, WIS.
Pulp—775 tpd deinked
Tissue, toweling, napkin grades—850 tpd

Total production capacity:

PULP	
Deinked	1,550 tpd
PAPER	
Tissue, towel, napkin	1,650 tpd

Fraser Inc.

27 Rice St.
Edmundston, N.B. E3V 1S9
John P. Fisher, chairman/chief executive officer

Net sales (C$):	
1983	$435,913,000
1982	397,605,000
Net earnings (C$):	
1983	10,755,000
1982	-4,761,000

Paper and paper/board accounted for 96% of Fraser's 1983 total sales, and printing/writing paper grades account for 90% of this.

Sales of Fraser products in 1983 comprised 469,938 metric tons of paper and paperboard: 216,230 tons of fine papers; 91,548 tons of uncoated groundwood papers; 133,547 tons of coated groundwood papers; 28,613 tons of boxboard.

Sales of market pulp were 2,644 tons. The Atholville pulp mill was inoperative for much of the year due to a major modernization program and conversion to magnesium bisulfite pulping. The mill reached its initial startup phase at the end of the year.

All major facilities of Fraser have been brought to cost-competitive condition and the overall capacity of the company has been increased by 50% since 1978. Capital spending in 1983 was $94,000,000.

In early 1983, Fraser acquired from MacMillan Bloedel a 50% interest in Island Paper Mills Ltd., New Westminster, B.C., the only western Canadian mill producing uncoated free-sheet paper. A new machine came online in mid-year at the Island mill.

Fraser owns 766,000 acres of timberland in Canada, and controls 1,107,000 acres under Crown license.

Production facilities:

MADAWASKA, MAINE
(Fraser Paper Ltd.)
Uncoated groundwood papers—360 short tpd
Uncoated free-sheet—430 tpd
Coated papers—440 tpd

NEW WESTMINSTER, B.C.
(Island Paper Mills Ltd.)
Uncoated free-sheet—320 metric tpd
(Fraser's share—160 tpd)

ATHOLVILLE, N.B.
Pulp—340 metric tpd magnesium bisulfite (for market)

EDMUNDSTON, N.B.
(Fraser Inc.)
Pulp—363 metric tpd groundwood, 535 tpd bleached and unbleached sulfite
Paperboard—86 metric tpd

THOROLD, ONT.
(Fraser Paper Ltd.)
Pulp—100 metric tpd deinked
Coated and uncoated free-sheet—245 metric tpd

Total production capacity:

PULP	
Groundwood	363 metric tpd
Magnesium bisulfite	340 metric tpd
Sulfite	535 metric tpd
Total	1,238 metric tpd
PAPER & BOARD	
Printing/writing papers	1,465 metric tpd
Paperboard	86 metric tpd
Total	1,551 metric tpd

Garden State Paper Co. Inc.

111 N. Fourth St.
Richmond, Va. 23219
Basil Snider Jr., president/chief executive officer

(A wholly-owned subsidiary of Media General Inc. which also has a 33⅓% interest in Southeast Paper Mfg. Co. and 20% interest in FSC Paper Co. These mills license and utilize the Garden State process for making newsprint; as does Productora Nacional de Papel Destintado in Mexico, in which Media General has a 49% interest)

Net sales:	
1983	$151,573,000
1982	153,734,000
Operating profit:	
1983	17,072,000
1982	27,226,000

Approximately 86% of Garden State sales are derived from paper.

Production of recycled newsprint in 1983 was 318,613 tons.

Capital expenditures in 1983 were $2,951,481, and are expected to be $3,500,000 in 1984.

Production facilities:

POMONA, CALIF.
Pulp—400 tpd deinked
Newsprint—370 tpd

DUBLIN, GA.
(Southeast Paper Mfg. Co., joint venture)
Pulp—450 tpd deinked (150 tpd Garden State's share), 50 tpd TMP (17 tpd Garden State's share)
Newsprint—450 tpd newsprint (150 tpd Garden State's share)

GARFIELD, N.J.
Pulp—700 tpd deinked
Newsprint—600 tpd

ALSIP, ILL.
(FSC Paper Corp., joint venture)
Pulp—360 tpd deinked (72 tpd Garden State's share)
Newsprint—305 tpd (61 tpd Garden State's share)

Total production capacity:

PULP	
Thermomechanical	17 tpd
Deinked	1,322 tpd
Total	1,339 tpd
PAPER	1,281 tpd

Georgia-Pacific Corp.

133 Peachtree St. N.E.
Atlanta, Ga. 30303
T. Marshall Hahn Jr., chairman/president/chief executive officer

Net sales:	
1983	$6,469,000,000
1982	5,402,000,000
Net income:	
1983	105,000,000*
1982	153,000,000*

*Extraordinary charge

Sales in 1983 were a record $6,500,000, some 20% above recession-affected 1982. Income for both years was affected by unusual charges.

In an effort to streamline and strengthen operations, major changes in product mix are planned at G-P mills in Florida and Arkansas. The 1,400-tpd Crossett complex is to be converted to production of bleached board and forms bond, and unbleached kraft paper capacity expanded at the 1,050-tpd Palatka mill. In addition, G-P agreed in May 1984 to acquire the Monticello, Miss., linerboard mill from St. Regis, and plans to increase capacity to 1,900-tpd.

Sales of pulp and paper in 1983 were $1,787,000,000. Production of pulp in 1983 was 2,976,000 tons. Paper output was 2,375,000 tons and tissue production 422,000 tons.

G-P owns 4,245,000 acres of timberland in U.S. and 370,000 acres in Canada; and 515,000 acres in U.S. are controlled, for a total of 5,130,000 acres.

Production facilities:

CROSSETT, ARK.
Pulp—1,450 tpd kraft (200 tpd for market)
Kraft paper—492 tpd
Tissue and towel—438 tpd
Solid bleached board—465 tpd

PALATKA, FLA.
Pulp—1,175 tpd kraft (150 tpd for market)
Packaging, industrial converting paper—683 tpd
Tissue—403 tpd

TAYLORVILLE, ILL.
Printing/writing paper—100 tpd

GARY, IND.
Pulp—85 tpd deinked
Tissue and towel—77 tpd

PORT HUDSON, LA.
Pulp—1,275 tpd bleached kraft (for market)

WOODLAND, MAINE
Pulp—795 tpd kraft (550 tpd for market)
Groundwood specialties—267 tpd

KALAMAZOO, MICH.
Pulp—240 tpd deinked
Printing paper—398 tpd

MONTICELLO, MISS.
(former St. Regis mill)
Pulp—1,955 tpd unbleached kraft
Paper & board—444 tpd industrial converting paper; 1,206 tpd unbleached kraft board

DELAIR, N.J.
Gypsum board liner—207 tpd

LYONS FALLS, N.Y.
Pulp—120 tpd semichemical, 30 tpd deinked
Printing paper—212 tpd

PLATTSBURGH, N.Y.
Pulp—103 tpd semichemical
Tissue and towel—244 tpd

PRYOR, OKLA.
Pulp—50 tpd defibrated
Gypsum paperboard—203 tpd

TOLEDO, ORE.
Pulp—1,433 tpd kraft, 426 tpd semichemical
Unbleached kraft paper—386 tpd
Unbleached kraft board—805 tpd

READING, PA.
Printing paper—60 tpd

GILMAN, VT.
Pulp—30 tpd deinked
Printing paper—200 tpd

BELLINGHAM, WASH.
Pulp—580 tpd sulfite (350 tpd for market), 115 tpd semichemical
Tissue and towel—250 tpd

TOMAHAWK, WIS.
Tissue and towel—25 tpd

THOROLD, ONT.
Gypsum paperboard—298 metric tpd (328 short tons)

Total production capacity:

PULP		
Kraft		8,083 tpd
Semichemical		764 tpd
Sulfite		580 tpd
Defibrated		50 tpd
Deinked		385 tpd
Total	9,862 tpd	
PAPER		
Printing/writing		970 tpd
Groundwood specialties		267 tpd
Tissue		1,437 tpd
Kraft papers		878 tpd
Packaging/industrial		1,127 tpd
Total	4,679 tpd	
PAPERBOARD		
Unbleached kraft board		2,011 tpd
Bleached board		465 tpd
Gypsum board liner		708 tpd
Total	3,184 tpd	
TOTAL PAPER & BOARD		7,863 tpd

Gilman Paper Co.

111 W. 50th St.
New York, N.Y. 10020
Howard Gilman, chairman/president/chief executive officer

Financial and production data not available.

Production facilities:

ST. MARYS, GA.
(St. Marys Kraft Div.)
Pulp—1,200 tpd kraft (750 tpd bleached, 450 tpd unbleached)
Paper & board—1,200 tpd (half paper, half board; bleached and unbleached, coated and uncoated)

Total production capacity:

PULP	1,200 tpd
PAPER & BOARD	1,200 tpd

P.H. Glatfelter Co.

Main St.
Spring Grove, Pa. 17362
T.C. Norris, president/chief executive officer

(Owns Glatfelter Pulp Wood Co.)

Net sales:	
1983	$257,091,000
1982	247,403,000
Net earnings:	
1983	20,583,000
1982	19,890,000

Improvement in 1983 in demand for Glatfelter's paper grades permitted operation of both the Spring Grove, Pa., and Neenah, Wis., plants at close to full capacity for the entire year. Market strength also permitted reopening of the West Carrollton, Ohio, mill (shut down in spring 1982) and two of the three machines were restarted in late 1983; however, in mid-1984, Glatfelter agreed to sell the West Carrollton mill to Appleton Papers Inc.

Capital spending in 1983 was about $14,500,000—$3,400,000 at the Neenah mill and $11,100,00 for Spring Grove and the pulpwood subsidiary. Spending in 1984 includes $10,000,000 to complete rebuild and upgrade of a paper machine at Spring Grove.

Company timberlands, managed by Glatfelter Pulp Wood Co., comprise 101,000 acres.

Production facilities:

SPRING GROVE, PA.
Pulp—550 tpd bleached kraft
Printing/writing papers—575 tpd

NEENAH, WIS.
(Bergstrom Paper Div.)
Pulp—250 tpd bleached deinked
Fine papers—325 tpd

Total production capacity:

PULP	
Bleached deinked	250 tpd
Kraft	550 tpd
Total	800 tpd
PAPER	
Fine papers	325 tpd
Printing/writing	575 tpd
Total	900 tpd

Great Lakes Forest Products Ltd.

Box 430
Thunder Bay, Ont. P7C 4W3
Charles J. Carter, chairman/president

(Canadian Pacific Enterprises owns approximately 54% of Great Lakes)

Net sales (C$)	
1983	$494,981,000
1982	437,854,000
Net income (C$)	
1983	9,936,000
1982	18,552,000

Pulp and Paper accounted for C$453,185,000 in sales in 1983. The operating loss was due mainly to weak prices and increased labor costs. In both 1983 and 1982, 86% of company sales were exported, largely to U.S. destinations and priced in U.S. dollars.

Shipments of newsprint from the Thunder Bay mill in 1983 were 393,000 metric tons; kraft market pulp shipments were 531,000 tons. The Dryden fine paper mill shipped 46,000 tons, some to midwestern U.S. but primarily to Canadian markets.

Capital expenditures in 1983 were $56,000,000, much of this for the expanded pulp mill and new paper machine at the Dryden mill.

Production facilities:

DRYDEN, ONT
Pulp—570 metric tpd kraft, bleached and unbleached
Fine and kraft papers—345 metric tpd

THUNDER BAY, ONT
Pulp—1,280 metric tpd bleached kraft (for market); 300 tpd high-yield sulfite, 910 tpd groundwood
Newsprint—1,190 tpd metric

Total production capacity:

PULP	
Kraft	1,850 metric tpd
Sulfite	300 metric tpd
Groundwood	910 metric tpd
Total	3,060 metric tpd
PAPER	
Fine and kraft papers	345 metric tpd
Newsprint	1,190 metric tpd
Total	1,535 metric tpd

Great Northern Nekoosa Corp.

75 Prospect St., P.O. Box 9309
Stamford, Conn. 06904
Willaim R. Laidig, president/chairman/chief executive officer

Net sales:	
1983	$1,565,000,000
1982	1,429,700,000
Net earnings:	
1983	84,000,000
1982	78,500,000

Sales of pulp, paper/board and converted products comprise 95% of GNN total. In 1983, sales of paper were $839 million; containerboard sales were $200 million; market pulp $24 million; and paper converting and distribution $507 million.

Production in 1983 was 2,293,500 tons of paper and paperboard, plus 80,504 tons of market pulp. Shipments of business/communications paper grades were 695,000 tons; groundwood printing, 442,000 tons; newsprint 275,000 tons. Containerboard shipments (including grocery sack paper) were 901,000 tons; market pulp, 79,000 tons.

GNN capital expenditures in 1983 were $388,800,000, with $260,000,000 expected to be spent in 1984. Major investment is the new $560-million market pulp mill for Leaf River Forest Products Inc. at New Augsta Miss. Scheduled to come onstream in Sept 1984, the 367,000 tpd of Leaf River pulp will bring GNN's total pulp capacity to 2.9 million tpy.

In early 1984, GNN completed acquisition of additional timberlands to bring total holding to 2.9-million acres.

Production facilities:

ASHDOWN, ARK.
(Nekoosa Papers)
Pulp—1,400 tpd bleached kraft (215 tpd for market)
Business communication paper—1,000 tpd

CEDAR SPRINGS, GA.
(Great Southern Paper)
Pulp—2,030 tpd kraft, 440 tpd semichemical
Linerboard—1,920 tpd
Corrugating medium—500 tpd

EAST MILLINOCKET, MAINE
(Great Northern Paper)
Pulp—725 tpd groundwood
Newsprint, groundwood printing papers—920 tpd

MILLINOCKET, MAINE
(Great Northern Paper)
Pulp—840 tpd groundwood, 710 tpd sulfite
Groundwood specialty paper—1,400 tpd
Wrapper—25 tpd

NEW AUGUSTA, MISS.
(Leaf River Forest Products)
After startup in Sept. 1984, will produce 1,000 tpd bleached kraft pulp (for market)

NEKOOSA, WIS.
(Nekoosa Papers)
Pulp—350 tpd kraft
Business communication papers—490 tpd

PORT EDWARDS, WIS.
(Nekoosa Papers)
Pulp—225 tpd sulfite
Business communications papers—410 tpd

Total production capacity:

PULP	
Kraft	3,780 tpd
Semichemical	440 tpd
Groundwood	1,565 tpd
Sulfite	935 tpd
Total	6,720 tpd
PAPER & BOARD	
Newsprint, groundwood papers	2,320 tpd
Business communications papers	1,900 tpd
Containerboard	2,420 tpd
Wrapper	25 tpd
Total	6,665 tpd

Green Bay Packaging Inc.

Box 1107
Green Bay, Wis. 54305
James F. Kress, president, chief executive officer

(Arkansas Kraft Corp. is a subsidiary)

Financial data not available.

Production facilities:

MORRILTON, ARK.
(Arkansas Kraft Corp.)
Pulp—800 tpd unbleached kraft
Kraft linerboard—1,075 tpd

GREEN BAY, WIS.
(Paper Mill Div.)
Pulp—220 tpd semichemical
Corrugating medium & specialty board—350 tpd

Total production capacity:

PULP	
Semichemical	220 tpd
Unbleached kraft	800 tpd
Total	1,020 tpd
PAPERBOARD	1,425 tpd

Gulf States Paper Corp.

Box 3199
Tuscaloosa, Ala. 35401
J.W. Warner, chairman/president

Financial data not available.

Production in 1983 was 185,400 tons of bleached foodboard, coated and uncoated, and 27,800 tons of bleached kraft market pulp.

Production facilities:

DEMOPOLIS, ALA.
Pulp—590 tpd unbleached kraft (55 tpd for market)
Paperboard—575 tpd bleached foodboard

Total production capacity:

PULP	590 tpd
PAPERBOARD	575 tpd

Hammermill Paper Co.

East Lake Rd., Box 1440
Erie, Pa. 16533
Albert F. Duval, chairman/chief executive officer

(Owns one-third of Grays Harbor Paper Co.)

Net sales:	
1983	$1,622,695,000
1982	1,395,950,000
Net earnings:	
1983	32,548,000*
1982	33,952,000*

*Extraordinary item

Net sales for Hammermill in 1983 were at an all-time high, but earnings were down 4% from the 1982 level. Some "unusual tax effects" made the two years' results "not truly comparable" (before taxes and extraordinary items, 1983 profits were 32% above 1982).

Sales of fine and printing paper (including market pulp from the expanded Selma mill) in 1983 were $517,100,000; industrial and packaging papers were $238,100,000; forest products $145,200,000; and converted paper products $119,400,000. Wholesale paper distribution sales were $726,500,000.

Production of paper and paperboard at Hammermill mills in 1983 was 822,000 tons; pulp output was 214,300 tons.

Capital expenditures in 1983 were $57,000,000; and $120,000,000 is expected to be spent in 1984. As of end-1983, Hammermill's annual pulpmaking capacity was 774,000 tons; and papermaking capacity was 527,000 tons of fine and printing grades, 241,000 tons industrial/packaging grades, plus 112,000 tons for the company's ⅓ interest in Grays Harbor Paper Co.

Hammermill owns 305,000 acres of timberland in U.S., and controls an additional 120,000 acres.

Production facilities:

SELMA, ALA.
(Riverdale Plant, HPG)
Pulp—1,100 tpd bleached kraft (525 tpd for market)

WESTFIELD, MASS.
(Strathmore Paper Co., including facilities at Westfield, Millers Falls, Turners Falls and Woronoco, Mass.)
Printing/writing paper—130 tpd

OSWEGO, N.Y.
(Oswego Plant, HPG)
Printing/writing paper—212 tpd

GREEN ISLAND, N.Y.
(Manning Paper Co.)
Packaging industrial converting paper—30 tpd

HAMILTON, OHIO
(Beckett Paper Co.)
Printing/writing paper—130 tpd

ERIE, PA
(Erie Plant, HPG)
Pulp—680 tpd Neutracel II bleached alkaline (for market)
Printing/writing paper—469 tpd

LOCK HAVEN, PA.
(Lock Haven Plant, HPG)
Printing/writing paper—571 tpd

HOQUIAM, WASH.
(Grays Harbor Paper Co., jointly owned)
Printing, writing & related paper—336 tpd (112 tpd Hammermill's share)

KAUKAUNA, WIS.
(Thilmany Pulp & Paper)
Pulp—423 tpd bleached and unbleached kraft
Packaging industrial converting paper—555 tpd

Total production capacity:

PULP	
Kraft	1,523 tpd
Alkaline	680 tpd
Total	2,203 tpd
PAPER	
Printing/writing paper	1,624 tpd
Packaging, industrial converting	585 tpd
Total	2,209 tpd

ITT Rayonier Inc.

1177 Summer St.
Stamford, Conn. 06904
Ronald M. Gross, chairman/president/chief executive officer

(ITT Rayonier is a subsidiary of ITT Corp. ITT operations include Rayonier New Brunswick, a division of ITT Industries of Canada Ltd. ITT Rayonier jointly owns (67%) Grays Harbor Paper Co. with Hammermill, which operates the mill and markets its products)

Net sales: (Forest Products Div.)	
1983	$620,000,000
1982	565,000,000
Operating income:	
1983	66,000,000
1982	9,000,000

Market pulp sales by ITT Rayonier in 1983 were $324 million, 52% of the Forest Products group total. Pulp output was 687,000 metric tons, up 13% from 1982. By individual mill, pulp production in 1983 was: Jesup, Ga., 383,000 metric tons; Port Angeles, Wash. 138,000; Fernandina, Fla., 93,000 tons; Grays Harbor, Wash., 83,000 tons.

Capital spending in 1983 was $59 million, and $91 million was budgeted for 1984.

Rayonier timberlands in the U.S. comprise 1,336,000 acres, of which 099,00 acres are owned and 237,000 acres controlled.

The possibility of reopening the Port Cartier, Que., market pulp mill (closed in 1979) was in the news in spring 1984, with Svenska Cellulosa AB of Sweden and Tembec Inc. reported to be studying such a project. The mill was being held on a standby basis, with aid from provincial and federal governments, for another 12 months, according to a local newspaper.

Production facilities:

FERNANDINA BEACH, FLA.
(Fernandina Div.)
Pulp—460 short tpd sulfite (for market)

JESUP, GA.
(Jesup Div.)
Pulp—1,400 tpd kraft dissolving and bleached papermaking (for market)

HOQUIAM, WASH.
(Grays Harbor Div.)
Pulp—200 tpd sulfite

HOQUIAM, WASH.
(Grays Harbor Paper Co.)
Printing/writing paper—336 tpd
(Rayonier's share 224 tpd)

PORT ANGELES, WASH.
(Port Angeles Div.)
Pulp—485 tpd sulfite (for market)

PORT CARTIER, QUE.
(Rayonier Quebec Ltd.)
(Mill closed)

Total production capacity (short tons):

PULP		
Sulfite	1,165 tpd	
Kraft	1,400 tpd	
Total		2,565 tpd
PAPER		224 tpd

International Paper Co.

77 W. 45th St.
New York, N.Y. 10036
John A. Georges, president/chief executive officer

Net sales:	
1983	$4,357,100,000
1982	4,015,200,000
Net earnings:	
1983	254,900,000
1982	171,800,000

IP's earnings in 1983 were 48% above those of 1982, on sales that increase 8.5%. By business segment, "pulp and paper" sales were $1.4 billion, 34% of IP total; "packaging and packaging materials" accounted for sales of $2.0 billion, 47% of total.

IP operates 15 pulp and paper mills in the U.S., with a total capacity in 1983 for: 1.8-million tons of printing/writing papers and bristols; 700,000 tons of paper pulp; chemical cellulose and specialty pulps; 300,000 tons of newsprint; 530,000 tons of kraft papers; 1.9-million tons of container board; 800,000 tons of bleached packaging board.

Capital spending at pulp, paper and packaging facilities was $588 million in 1983; of this, $220 million was for modernization programs and $368 million for expansion. In 1984, corporatewide spending is budgeted at $785 million, of which $565 million goes for pulp/paper/packaging facilities ($295 million for modernization, $270 million for expansion). Major projects are the conversion of the Georgetown, S.C., mill to production of bleached pulp and white papers (due for completion in 1984) and a similar reconstruction program at the Mobile, Ala., mill (to be completed in 1985). With shutdown of newsprint machines at the Pine Bluff, Ark., mill and the conversion at Mobile, IP will phase out of newsprint production.

Production facilities:

MOBILE, ALA.
Pulp—1,035 tpd kraft, 180 tpd groundwood, 55 tpd thermomechanical
Newsprint—340 tpd
Printing/writing paper—215 tpd
Packaging/industrial converting paper—800 tpd

CAMDEN, ARK.
Pulp—725 tpd kraft
Packaging/industrial converting paper—715 tpd

PINE BLUFF, ARK.
Pulp—1,125 tpd bleached kraft
Solid bleached board—1,035 tpd

BASTROP, LA.
(Mill idle)

BASTROP, LA.
(Louisiana Mill)
Pulp—1,200 tpd bleached kraft
Printing/writing paper—500 tpd
Solid bleached board—550 tpd

MANSFIELD, LA.
Pulp—1,450 tpd unbleached kraft, 550 tpd semichemical
Linerboard—1,300 tpd
Corrugating medium—750 tpd

PINEVILLE, LA.
Pulp—975 tpd kraft
Unbleached kraft board—985 tpd

JAY, MAINE
(Androscoggin Mill)
Pulp—1,200 tpd bleached kraft, 130 tpd groundwood
Printing/writing paper—1,305 tpd

MOSS POINT, MISS.
Pulp—750 tpd kraft
Printing/writing paper—150 tpd
Packaging/industrial converting paper—100 tpd
Solid bleached board—535 tpd

NATCHEZ, MISS.
Pulp—1,135 tpd bleached kraft (for market)

VICKSBURG, MISS.
Pulp—1,180 tpd kraft
Unbleached kraft board—1,350 tpd

CORINTH, N.Y.
(Hudson River Mill)
Pulp—150 tpd groundwood
Printing/writing paper—480 tpd

TICONDEROGA, N.Y.
Pulp—530 tpd bleached kraft
Printing/writing paper—690 tpd

GARDINER, ORE.
Pulp—800 tpd kraft
Unbleached kraft board—850 tpd

GEORGETOWN, S.C.
Pulp—1,600 tpd bleached kraft (some for market)
Printing/writing paper—325 tpd
Solid bleached board—315 tpd

TEXARKANA, TEXAS
Pulp—1,300 tpd kraft (est. 500 tpd for market)
Solid bleached board—650 tpd ('swing' to market pulp or additional bleached board)

Total production capacity:

PULP		
Kraft	15,005 tpd	
Groundwood	460 tpd	
Thermomechanical	55 tpd	
Semichemical	550 tpd	
Total		16,070 tpd
PAPER		
Newsprint	340 tpd	
Printing/writing	3,665 tpd	
Packaging/industrial converting	1,615 tpd	
Total		5,620 tpd
PAPERBOARD		
Solid bleached board	3,085 tpd	
Unbleached kraft board	5,235 tpd	
Total		8,320 tpd
TOTAL PAPER & BOARD		13,940

Interstate Resources Inc.

1111 Central Trust Center
201 East 5th St.
Cincinnati, Ohio 45202.
John J. McLaughlin, president/chief executive officer

(In mid-1982 Interstate Paper Corp. and Interstate Intercorr Corp. were merged into Interstate Resources Inc., a new Cincinnati-based, privately owned company)

Financial data not available.

Interstate production in 1983 was 192,000 tons of paperboard.

Capital spending in 1983 was $205,000, with $6 million to be spent in 1984 in the multiyear upgrade program that includes an additional 53,000 tpy of linerboard capacity by 1986.

Production facilities:

RICEBORO, GA.
(Interstate Paper Corp.)
Pulp—525 tpd kraft
Linerboard—600 tpd

READING, PA.
(Interstate Intercorr Corp.)
Corrugating medium—100 tpd

Total production capacity:

PULP	525 tpd
PAPERBOARD	
Linerboard	600 tpd
Corrugating medium	100 tpd
Total	700 tpd

Irving Pulp & Paper Ltd.

Box 3007
St. John, N.B. E2M 3H1
J.K. Irving, president

Financial data not available.

Production facilities:

ST. JOHN, N.B.
(Irving Pulp & Paper Ltd.)
Pulp—750 metric tpd bleached and semibleached kraft (for market)

ST. JOHN, N.B.
(Rothesay Paper Ltd.)
Pulp—525 metric tpd groundwood, 300 tpd thermomechanical
Newsprint—900 metric tpd

ST. GEORGE, N.B.
(Lake Utopia Paper Ltd.)
Corrugating medium—225 metric tpd

Total production capacity:

PULP	
Kraft	750 metric tpd
Groundwood	525 metric tpd
TMP	300 metric tpd
Total	1,575 metric tpd
PAPER & BOARD	
Newsprint	900 metric tpd
Corrugating medium	225 metric tpd
Total	1,155 metric tpd

Jacksonville Kraft Paper Co.

Box 18019
Jacksonville, Fla.
Ben Westby, president/chief executive officer

Jacksonville Kraft Paper was formed in early 1983, to purchase the kraft paper/board mill from St. Regis Paper. The mill started up under its new management in June 1983. Financial data are not available.

Production facilities:

JACKSONVILLE, FLA.
Pulp—1,400 tpd unbleached kraft
Kraft paper and linerboard—1,300 tpd

Total production capacity:

PULP	1,400 tpd
PAPER & BOARD	1,300 tpd

James River Corp.

Box 2218
Richmond, Va. 23217
Brenton S. Halsey, chairman/chief executive officer

Net sales:	
1984	$2,301,076,000
1983	1,656,112,000
Net income:	
1984	97,995,000
1983	55,148,000
(fiscal year ended Apr. 29, 1984)	

James River's fiscal-1984 sales represent a 39% rise over the preceding year, and earnings were 78% higher than for the 1983 period.

By product lines, James River's 1984 sales were: sanitary paper products, $644,301,000; communication papers $299,140,000; specialty papers $460,215,000; paperboard packaging $368,172,000; disposable food/beverage products $391,183,000; pulp, coated film and other $138,065,000.

Since its organization in 1969, James River has grown by acquisitions and in 1984 comprises 69 paper and converting plants in U.S., Canada and Scotland, with 66 paper machines. Most recent members of the James River group are the ex-American Can market pulp mill at Marathon, Ont., (acquired in spring 1983 in an 80% James River/20% Buchanan Forest Products Ltd. joint venture), and four pulp and paper mills in the Northeast from Diamond International in mid-1983.

Production for 1983 was 1.5 million tons of paper and paperboard and 1 million tons of pulp.

Capital expenditures in 1983 were $77,043,000, and $125,000,000 was budgeted in 1984 spending. During 1983, James River initiated a five-year capital spending program totaling $800,000,000. This program is geared to reinforce and expand business lines (sanitary paper products, specialty and communication papers, disposable food and beverage service products, paperboard packaging) and increase internal capacity to supply pulp and bleached board. A program of paper machine rebuilds was initiated to upgrade quality as well as to expand capacity in all business lines.

James River owns 200 acres of timberland in the U.S., with control of 1,729 acres in the U.S. and 1,650 acres in Canada.

Production facilities:

Specialty Packaging Papers Group:

PARCHMENT, MICH.
(KVP Group)
Specialty papers—400 tpd

HUGHESVILLE, N.J.
(Riegel Custom Products)
Specialty papers—40 tpd

RIEGELSVILLE, N.J.
(Mill closed 1982—15 tpd specialty papers)

WARREN GLEN, N.J.
(Riegel Custom Products)
Specialty papers—80 tpd

Specialty Industrial Papers Group:

JAY, MAINE
(James River-Otis Inc.)
Specialty papers—135 tpd

EAST PEPPERELL, MASS.
(James River-Pepperell Inc.)
Specialty papers—75 tpd

FITCHBURG, MASS.
(James River-Fitchburg, Filter Paper Div.)
Specialty papers—60 tpd

FITCHBURG, MASS.
(James River-Massachusetts Inc.)
Specialty papers—300 tpd

ROCHESTER, MICH.
(James River-Rochester, Filter Paper Div.)
Specialty papers—15 tpd

MILFORD, N.J.
(Riegel Packaging Papers Div.)
Specialty papers—250 tpd

RICHMOND, VA.
(James River Paper, Filter Paper Div.)
Specialty papers—26 tpd

Berlin/Gorham Group:

BERLIN, N.H.
(Pulp Div.)
Pulp—800 tpd kraft (some for market); 210 tpd semichemical

GORHAM, N.H.
(Paper Div.)
Paper—350 tpd printing/industrial paper

MARATHON, ONT.
(James River-Marathon Ltd.)
Pulp—450 metric tpd bleached kraft (for market)

Groveton Group:

HYDE PARK, MASS.
(Hyde Park Mill)
Pulp—125 tpd deinked
Printing/writing paper—200 tpd

GROVETON, N.H.
(Groveton Paper Board Inc. (separately owned), managed by James River Corp.)
Pulp—250 tpd semichemical
Corrugating medium—300 tpd

GROVETON, N.H.
(Groveton Papers Inc.)
Fine papers—300 tpd
Tissue—70 tpd

GOUVERNEUR, N.Y.
(Natural Dam Div.)
Tissue—45 tpd

Specialty Printing Paper Group:

NEWARK, DEL.
(Newark Mill, Curtis Div.)
Printing/writing papers—24 tpd

ADAMS, MASS.
(Adams Mill, Curtis Div.)
Specialty papers—40 tpd

YPSILANTI, MICH.
(Ypsilanti Mill, Curtis Div.)
Printing/writing papers—50 tpd

Towel & Tissue Business:

PENNINGTON, ALA.
(Naheola Mill)
Pulp—1,000 tpd kraft
Solid bleached board—550 tpd
Tissue and towel—350 tpd

OLD TOWN, MAINE
(Old Town Mill)
Pulp—600 tpd bleached kraft (some for market)
Tissue—170 tpd

BERLIN, N.Y.
(Gorham Absorbent Products)
Tissue and towel—150 tpd

HALSEY, ORE.
(Halsey Mill)
Tissue and towel—240 tpd

ASHLAND, WIS.
(Ashland Mill)
Creping tissue—55 tpd

GREEN BAY, WIS.
(Green Bay Mill)
Pulp—170 tpd bleached sulfite
Tissue and towel—450 tpd

Paperboard Packaging Business:

KALAMAZOO, MICH.
Recycled paperboard—400 tpd

Total production capacity:

PULP		
Kraft		2,900 tpd
Semichemical		460 tpd
Bleached sulfite		170 tpd
Deinked		125 tpd
Total	3,655 tpd	

PAPER & BOARD		
Specialty grades		1,421 tpd
Tissue, towel		1,530 tpd
Printing/writing		574 tpd
Printing/industrial		350 tpd
Solid bleached board		550 tpd
Corrugating medium		300 tpd
Recycled board		400 tpd
Total	5,125 tpd	

Kimberly-Clark Corp.

128 N. Lake St.
Neenah, Wis. 54956
Darwin E. Smith, chairman/chief executive officer

(Subsidiaries include Kimberly-Clark of Canada Ltd., 100% owned, and Spruce Falls Power & Paper Co. Ltd., 50.5%)

Net sales:	
1983	$3,274,300,000
1982	2,946,100,000
Net earnings:	
1983	188,800,000
1982	197,400,000

K-C's 1983 sales were at a record high, with higher unit volumes accounting for essentially all the growth. Operating profits were also at an all-time high, but net income declined 4% from 1982. A 49% decline in operating profit of the Newsprint, Pulp & Forest Products Class was a contributing factor to 1983's lower earnings.

K-C's tissue mills are included in the Consumer & Service Class, which accounts for about 69% of sales. K-C's production capacity for sanitary tissue at end-1983 was 392,400 metric tons in the U.S. and 662,000 metric tons elsewhere. K-C's primary production of tissue in the U.S. in 1983 was 386,000 metric tons, estimated to be 8.9% of U.S.-made tissue.

Newsprint, Pulp & Forest Products Class accounts for about 16% of sales. K-C capacity for newsprint and groundwood printing papers was 379,000 metric tons in U.S. and 347,000 metric tons in Canada. Production of these grades in 1983 was 646,000 metric tons, 4.9% of U.S./Canada total.

Pulp production at K-C mills in 1983, primarily in North America, was 1,469,000 metric tons, most of which is consumed internally. Approximately 560,000 tons were market pulp.

Paper & Specialties Class accounts for about 13% of K-C sales. Production of mills in this group in 1983 was 45,000 metric tons of thin papers (15.1% of U.S. total); 133,000 metric tons of printing/business papers (0.9% of U.S.); and 15,000 metric tons of packaging/industrial converting grades (0.3% of U.S.).

Capital spending, primarily for Consumer & Service Class facilities, in 1983 was a record $363,000,000; for 1984 it is expected to be about $350,000,000.

K-C owns 552,945 acres of timberland in U.S., with 47,718 acres under lease or license; in Canada, K-C owns 195,960 acres and controls an additional 11,764,339 acres.

Production facilities:
(K-C is reporting data in metric tons; figures below have been converted to short tons)

COOSA PINES, ALA.
(Coosa River Newsprint)
Pulp—850 tpd bleached kraft (649 tpd for market), 753 tpd groundwood, 110 tpd TMP
Newsprint, groundwood printing paper—1,187 tpd

FULLERTON, CALIF.
Tissue—187 tpd

NEW MILFORD, CONN.
Tissue—187 tpd

LEE, MASS.
(Peter J. Schweitzer Div.)
Business/lightweight specialties—90 tpd

MUNISING, MICH.
Industrial specialties—98 tpd

SPOTSWOOD, N.J.
(Schweitzer Div.)
Cigaret papers—132 tpd

ANGRAM, N.Y.
(Schweitzer Div.)
Plug wrap, reconstituted grades—19 tpd

MT. HOLLY SPRINGS, PA.
(Schweitzer Div.)
Capacitor paper—15 tpd

BEECH ISLAND, S.C.
Tissue—265 tpd

MEMPHIS, TENN.
Tissue—314 tpd

NEENAH, WIS.
(Lakeview)
Tissue—216 tpd

NEENAH, WIS.
(Badger-Globe)
Tissue—60 tpd

NEENAH, WIS.
(Neenah Paper Co.)
Writing, specialty papers—112 tpd

WHITING, WIS.
(former Plover Papers mill)
Business communication papers—50 tpd

ST. JOHN, N.B.
(K-C of Canada)
Tissue—50 short tpd (42 metric)

HUNTSVILLE, ONT
(K-C of Canada)
Tissue—110 short tpd (100 metric)

KAPUSKASING, ONT
(K-C of Canada)
(Mill closed 1983)

KAPUSKASING, ONT
(Spruce Falls Power & Paper Co. Ltd.)
(K-C owns 50.5%)

Pulp—700 short tpd (635 metric) groundwood (K-C's share 321 metric tpd); 420 short tpd (381 metric) TMP (K-C's share 192 m tpd); 200 short tpd (181 metric) magnefite (K-C's share 91 m tpd)

Newsprint, groundwood printing papers—1,088 short tpd (987 metric); (K-C's share 549 short tpd))

ST. CATHARINES, ONT
(K-C of Canada)
Tissue & specialties—85 short tpd (77 metric)

TERRACE BAY, ONT
(K-C of Canada)
Pulp—1,250 short tons (1,134 metric) bleached kraft (for market)

Total production capacity:

PULP (short tons)	
Kraft	2,100 tpd
Magnefite	200 tpd
Groundwood	1,463 tpd
Thermomechanical	530 tpd
Total	4,293 tpd

PAPER (short tons)	
Newsprint/ groundwood specialties	2,275 tpd
Tissue	1,474 tpd
Printing, writing & specialties	516 tpd
Total	4,265 tpd

Kruger Inc.

3285 Bedford Rd.
Montreal, Que. H3S 1G5
J.S. Hermon, president/chief executive officer

Financial data not available, but 100% of Kruger's sales are derived from paper products.

Production at Kruger's three mills in 1981 totaled 583,321 metric tons.

Production facilities:

BROMPTONVILLE, QUE.
(Newsprint Div.)
Pulp—381 metric tpd groundwood, 272 tpd TMP
Newsprint—562 metric tpd

MONTREAL, QUE
(Turcot Paperboard Div.)
Recycled paperboard—272 metric tpd

TROIS-RIVIERES, QUE

Pulp—680 metric tpd groundwood, 200 tpd sulfite, 330 tpd TMP

Newsprint—726 metric tpd

Coated publication paper—363 metric tpd

Total production capacity:

PULP	
Sulfite	200 metric tpd
Groundwood	1,061 metric tpd
Thermomechanical	602 metric tpd
Total	1,863 metric tpd

PAPER & BOARD	
Newsprint	1,288 metric tpd
Coated publication	363 metric tpd
Paperboard	272 metric tpd
Total	1,923 metric tpd

Longview Fibre Co.

Box 639
Longview, Wash. 90632
R.P. Wollenberg, president/chief executive officer

Net sales:	
1983	$373,391,000
1982	371,463,000
Net earnings:	
1983	17,321,000
1982	42,646,000*

(fiscal year ending Oct. 31)

*In 1982, changes in accounting method for investment tax income increased net income for that year by $39,087,000

Sales of paper and paperboard in 1983, at $127,031,000, represented 34% of Longview's total; net income for paper/board products was 76.5% of 1983 income. Converted products accounted for 53.2% of sales and 24.7% of income.

Production at the Longview mill in 1983 totaled 274,000 tons of kraft paper, and 338,000 tons of paperboard, 356,000 tons of converted products.

Capital spending in 1983 was $42,722,000, and $27,000,000 is expected to be spent in 1984.

Longview timberland resources include 489,000 acres owned and 15,000 acres controlled, all in the U.S.

Production facilities:

LONGVIEW, WASH.

Pulp—2,760 tpd kraft; 240 tpd semichemical

Packaging, industrial converting paper—1,210 tpd

Unbleached kraft board—940 tpd

Semichemical board—200 tpd

Total production capacity:

PULP	
Kraft	2,760 tpd
Semichemical	240 tpd
Total	3,000 tpd

PAPER & BOARD	
Packaging/industrial converting paper	1,210 tpd
Unbleached kraft board	940 tpd
Semichemical board	200 tpd
Total	2,350 tpd

Louisiana-Pacific Corp.

1300 S.W. Fifth Ave.
Portland, Ore. 97201
Harry A. Merlo, chairman/president

Net sales:	
1983	$1,101,980,000
1982	872,190,000
Net earnings:	
1983	27,920,000*
1982	16,650,000

*Extraordinary charge

Sales of pulp and paperboard by Louisiana-Pacific in 1983 were $168,000,000, a drop from the 1982 level of $181,000,000, and represent only 15% of L-P's total revenue. It was a turnaround in building product markets that boosted L-P's 1983 sales 26% above 1982.

In fall of 1983, L-P proposed to sell its Ketchikan Div. (the 150,000-tpy pulp mill, three sawmills and long-term timber cutting rights) to an Employee Stock Ownership Trust, but these negotiations were terminated in mid-1984.

Pulp production at L-P's two mills in 1983 was 289,000 tons, representing 80% of capacity; production of paperboard was 224,000 tons, a 90% operating rate; output of corrugated containers was 1,002,000,000 ft², a rate of 81%.

L-P's timberlands include 920,000 acres owned and 1[illegible]0,000 acres controlled.

Production facilities:

KETCHIKAN, ALASKA
Pulp—600 tpd dissolving sulfite (for market)

ANTIOCH, CALIF
(Container Products Div.)

Pulp—600 tpd unbleached kraft, 175 tpd semichemical

Paperboard and/or kraft pulp—800 tpd

SAMOA, CALIF
Pulp—610 tpd kraft (for market)

Total production capacity:

PULP	
Dissolving	600 tpd
Kraft	1,210 tpd
Semichemical	175 tpd
Total	1,985 tpd
PAPERBOARD	800 tpd

MacMillan Bloedel Ltd.

1075 W. Georgia St.
Vancouver, B.C. V6E 3R9
R. V. Smith, president/chief executive officer

(MB is owned 49% by Noranda Mines Ltd.)

Net sales (C$)	
1983	$2,044,100,000
1982	1,843,100,000
Net earnings (C$)	
1983	23,900,000*
1982	57,300,000*

*Extraordinary item

MacMillan Bloedel is Canada's largest forest products company and was seriously affected by the depressed economy of recent years. Many operations of MB have been reconfigured, some have been closed. Over C$1,200,000,000 has been spent over the past five years for major modernizations and expansions. In early 1983, MB sold a one-half interest in Island Paper Mills, the only fine paper mill in western Canada, to Fraser Inc. (in which Noranda has a majority interest).

In 1983, sales of pulp, paper and containerboard were $800,000,000, of which newsprint was $458,400,000 and market pulp was $177,600,000. Sales of pulp, paper and converted products in 1983 totaled $1,098,200,000 (54% of MB corporate total).

Production by grades at MB mills in 1983 was 788,000 metric tons of newsprint; 369,000 tons of kraft market pulp; 299,000 tons of linerboard; 199,000 tons of corrugating medium.

Capital expenditures in 1983 were $103,600,000 of which $65,400,000 was for pulp/paper and containerboard/packaging facilities. Spending for 1984 has not been reported.

MB timberlands, owned or controlled, comprise 2,617,000 acres in British Columbia and 422,500 acres in U.S. (Alabama and Mississippi).

Production facilities:

PINE HILL, ALA.
(MacMillan Bloedel Inc.)
Pulp—1,075 short tpd unbleached kraft; 450 tpd semichemical
Linerboard—1,250 short tpd
Corrugating medium—600 short tpd

NANAIMO, B.C.
(Harmac Div.)
Pulp—965 metric tpd bleached kraft (for market)

NEW WESTMINSTER, B.C.
(Island Paper Mills Ltd. (owned 50:50 with Fraser Inc.))
Uncoated free sheet—320 metric tpd (MB's share, 160 tpd)

PORT ALBERNI, B.C.
(Alberni Pulp & Paper Div.)
Pulp—700 metric tpd unbleached kraft (190 tpd for market); 270 tpd bleached kraft; 945 tpd groundwood (including RMP)
Newsprint and/or groundwood specialties—1,100 metric tpd

POWELL RIVER, B.C.
(Powell River Div.)
Pulp—500 metric tpd kraft (100 tpd for market); 770 tpd groundwood; 700 tpd TMP (being converted to CTMP, by end-1985); 45 tpd RMP
Newsprint/groundwood-papers—1,750 metric tpd

STURGEON FALLS, ONT.
Pulp—250 metric tpd semichemical
Corrugating medium—203 metric tpd

Total production capacity:

PULP	
Kraft	3,410 metric tpd
Semichemical	658 metric tpd
Groundwood/RMP	1,760 metric tpd
TMP/CTMP	700 metric tpd
Total	6,528 metric tpd
PAPER & BOARD	
Newsprint/groundwood specialty	2,860 metric tpd
Containerboard	1,881 metric tpd
Fine papers	160 metric tpd
Total	4,901 metric tpd

Manville Forest Products Corp.

Box 488
West Monroe, La. 71291
W. T. Stephens, president

(Subsidiary of Manville Corp.)

Manville Corp. filed for protection under Chapter 11 of the federal bankruptcy code in mid-1982 to shield itself from future liabilities for asbestos-related health claims.

In early 1984, a proposed reorganization of Manville Forest was approved. Payments to creditors were to begin, with a goal of having all claims paid by end-January 1985.

In 1983, Manville Forest had sales of $426.9 million, and income from operations was $53.2 million.

Production facilities:

WEST MONROE, LA.
(Manville Forest Products Corp.)
Pulp—1,400 tpd kraft, 270 tpd semichemical
Paperboard—140 tpd
Coated paperboard—1,450 tpd
Kraft paper—120 tpd

Total production capacity:

PULP	
Kraft	1,400 tpd
Semichemical	270 tpd
Corrugating medium	330 tpd
Total	1,670 tpd
PAPER & BOARD	
Paperboard	1,590 tpd
Kraft paper	120 tpd
Corrugating medium	330 tpd
Total	2,040 tpd

Mead Corp.

Courthouse Plaza Northeast
Dayton, Ohio 45463
Burnell R. Roberts, chairman/chief executive officer

(Escanaba Paper Co. is a wholly-owned subsidiary. Mead also has a 50% interest in Brunswick Pulp & Paper Co., Georgia Kraft Co., Northwood Forest Industries, and Schoeller Technical Papers Inc., and a 15% direct interest in British Columbia Forest Products in addition to the 13% held indirectly through Brunswick P&P)

Net sales	
1983	$2,366,600,000
1982	2,127,600,000
Net earnings	
1983	42,600,000*
1982	85,800,000*

*Extraordinary charge

About 95% of Mead's revenue is from pulp/paper/converted products and distribution. Sales of market pulp in 1983 were $40.5 million. Paper sales were $818 million, paperboard and packaging $671.1 million, and paper converting and distribution $722.3 million. (Data include intersegment sales of $136.6 million.)

Production in 1983 at Mead and affiliated mills resulted in 526,000 tons of market pulp, 104,000 tons of newsprint, 1,085,000 tons of other paper and 1,496,000 tons of paperboard.

In 1983, Mead sold four non-forest products businesses, withdrew from ink-jet printing, and prepared to sell one other small unit. These moves are part of a long-term, strategic decision to focus more of Mead's resources in forest products.

Contributing to Mead's improved earnings in 1983 were the profitable operation of the two newest paper machines, at Escanaba, Mich. (startup mid-

1982) and at Chillicothe, Ohio (startup late-1981). During 4th-quarter 1983, the Escanaba machine averaged 105% of plan and Chillicothe averaged 97%; and the new pulp line at Northwood Pulp & Timber in Canada was operating at 91% of plan.

Capital spending in 1983 at Mead facilities was $70.4 million; total spending for Mead and affiliates in 1984 was scheduled to be $265 million.

Mead owns 1,153,000 acres of timberland in U.S. and controls an additional 581,000 acres.

Production facilities:

STEVENSON, ALA.
Pulp—600 tpd semichemical
Semichemical board—940 tpd

BRUNSWICK, GA.
(Brunswick Pulp & Paper)
Pulp—1,760 tpd kraft (Mead's share 880 tpd, 420 tpd for market. Brunswick mill has swing capacity between board and pulp of 460 tpd solid bleached board)

KRANNERT, MACON, GA. MAHRT, ALA.
(Georgia Kraft Co.)
Unbleached kraft board—4,572 tpd (Mead's share 2,286 tpd)

SOUTH LEE, MASS.
Packaging, industrial converting paper—62 tpd

ESCANABA, MICH.
(Escanaba Paper Co.)
Pulp—800 tpd combination hardwood and softwood kraft; 200 groundwood
Printing/writing paper—1,314 tpd

OTSEGO, MICH.
Combination (recycled) board—200 tpd

PULASKI, N.Y.
(Schoeller Technical Papers)
Packaging, industrial converting paper—70 tpd (Mead's share, 35 tpd)

CHILLICOTHE, OHIO
Pulp—625 tpd kraft
Printing/writing paper—1,171 tpd

CINCINNATI, OHIO
Combination (recycled) board—143 tpd

KINGSPORT, TENN.
Pulp—315 tpd soda
Printing/writing paper—557 tpd

LYNCHBURG, VA.
Combination (recycled) board—400 tpd

MENASHA, WIS.
(Gilbert Paper Co. Div.)
Printing/writing paper—77 tpd

CROFTON, B.C.
(B.C. Forest Products Ltd.)
Pulp—1,125 short (1,020 metric) tpd kraft (Mead's share 315 short tpd)
Newsprint—1,389 short (1,260 metric) tpd (Mead's share 389 short tpd)

MACKENZIE, B.C.
(B.C. Forest Products Ltd.)
Pulp—615 short (560 metric) tpd kraft (Mead's share 172 tpd) (110 metric tpd kraft pulp for market, Crofton and Mackenzie combined)

MACKENZIE, B.C.
(Finlay Forest Products Ltd.)
Pulp—496 short (450 metric) tpd refiner mechanical (60 short tpd, Mead's share through BCFP interest)

PRINCE GEORGE, B.C.
(Northwood Pulp & Timber Co. Ltd.)
Pulp—1,600 short (1,450 metric) tpd kraft (Mead's share 800 tpd, 400 tpd for market)

ST-FELICIEN, QUE.
(Donohue St-Felicien, through BCFP)
Pulp—760 short (690 metric) tpd kraft (Mead's share 96 short tpd (38 for market) through BCFP interest)

Total production capacity:

PULP (short tons)	
Kraft	3,688 tpd
Soda	315 tpd
Semichemical	600 tpd
Groudnwood	392 tpd
Refiner mechanical	60 tpd
Total	5,055 tpd
PAPER (short tons)	
Newsprint	389 tpd
Printing/writing	3,119 tpd
Packaging/industrial	97 tpd
Total	3,605 tpd
PAPERBOARD (short tons)	
Solid bleached	460 tpd
Kraft linerboard	2,286 tpd
Semichemical	940 tpd
Recycled board	743 tpd
Total	4,429 tpd
PAPER & BOARD (short tons)	8,034 tpd

National Gypsum Co.

4100 Inter First Two
Dallas, Texas 75270
Robert L. Sofres, chairman/chief executive officer

Gypsum board liner and insulation board produced by National Gypsum are included in Gold Bond Building Products Div. Financial data not available.

Production facilities:

ANNISTON, ALA.
Gypsum board liner—200 tpd

MOBILE, ALA.
Pulp—225 tpd groundwood
Insulation board—375 tpd

STOCKTON, CALIF.
Gypsum board liner—120 tpd
Chipboard—140 tpd

KALAMAZOO, MICH.
Gypsum board liner—150 tpd

PRYOR, OKLA.
Gypsum board liner—210 tpd

MILTON, PA.
Gypsum board liner—320 tpd

Total production capacity:

PULP (groundwood)	225 tpd
PAPERBOARD	
Gypsum board liner	1,000 tpd
Chipboard	140 tpd
Total	1,140 tpd
BUILDING (insulation board)	375 tpd

Newark Group Inc.

57 Freeman St.
Newark, N.J. 07105
Edward K. Mullen, president

(Newark Boxboard Co. is a subsidiary of Newark Group; California Paperboard Corp. is a subsidiary of Newark Boxboard; other paperboard mills are divisions of Newark Boxboard)

Financial data not available.

In mid-1984, Newark agreed to sell its recycled medium mill at Uncasville, Conn., to Stone Container, and in turn acquire from Stone its recycled board mills at Mobile, Ala., and Franklin, Ohio.

Production facilities:

MOBILE, ALA.
(former Stone Container mill)
Recycled boxboard—165 tpd

SANTA CLARA, CALIF.
(California Paperboard Corp.)
Recycled paperboard—200 tpd

HAVERHILL, MASS.
(Haverhill Paperboard Co. Div.)
Recycled paperboard—300 tpd

NATICK, MASS.
(Natick Paperboard Co. Div.)
Recycled paperboard—100 tpd

NEWARK, N.J.
(Newark Mill)
Recycled paperboard—125 tpd

FRANKLIN, OHIO
(former Stone Container mill)
Recycled boxboard—165 tpd

MIDDLETOWN, OHIO
(Middletown Paperboard Co. Div.)
Recycled paperboard—130 tpd

MILWAUKEE, WIS.
(Wisconsin Paperboard Corp. Div.)
Recycled paperboard—350 tpd

Total production capacity:

PAPERBOARD	1,535 tpd

Noranda Mines Ltd.

Box 45, Commerce Court W
Toronto, Ont. M5L 1B6
Alfred Powis, chairman/chief executive officer

(Noranda owns 100% of Northwood Mills. Northwood Mills owns 100% of James Maclaren Industries Inc., 63% of Fraser Inc., 50% of Northwood Forest Industries Ltd. and 49.8% of MacMillan Bloedel Ltd. Fraser and MacMillan Bloedel, which issue their own financial reports, are listed separately.

In 1983, Noranda's forest products interests aggregated C$3,251,600,000 in sales, of which Noranda's share was $1,947,500,000. Noranda's share of operating profit was $3,800,000.

In 1982, the sales total for the forest products operations was $2,829,300,000, of which Noranda's share was $1,710,300,000. Operating profit share was a minus $55,700,000.

Sales of 100%-owned James Mclaren Industries in 1983 were $164,900,000 and operating profit was $13,200,000. Maclaren's 1982 sales were $139,400,000 and operating profit was $19,400,000.

Sales in 1983 for Northwood Pulp & Timber were $291,400,000, of which Noranda's share was $145,700,000, and Noranda's operating loss was $11,900,000. Northwood's 1982 sales were $175,300,000 (Noranda's share $87,700,000) and Noranda's operating loss was $10,800,000.

The Northwood mill produced 367,000 metric tons of market pulp in 1983. The Maclaren mills produced 148,000 tons of newsprint and 109,000 tons of market pulp.

Including MacMillan and Fraser operation, output of Noranda's forest products group in 1983 was 1,902,000 tons of paper and board, and 848,000 tons of pulp. (Noranda's share was 1,087,000 tons of paper and board, and 478,000 tons of pulp.)

Capital expenditures in 1983 for the group was $152 million. The major project underway is a new paper machine for the Maclaren newsprint mill at Masson, Que., due to start up end-1985.

Timberlands managed by Maclaren include 40,000 acres owned, 2,100,000 acres controlled; timberlands for Northwood Pulp comprise 2,000 acres owned, 1,961,000 acres of timber harvesting rights.

Adding in timberlands owned or controlled by Fraser and MacMillan Bloedel, the Noranda forest products interests have cutting access to 9,989,000 acres.

Production facilities:

PRINCE GEORGE, B.C.
(Northwood Pulp & Timber)
Pulp—1,450 metric tpd bleached kraft (Noranda's share 725 tpd—for market)

MASSON, QUE.
(James Maclaren Industries Inc.)
Pulp—380 metric tpd groundwood; 118 tpd sulfite
Newsprint—430 metric tpd

THURSO, QUE.
(James Mclaren Industries Inc.)
Pulp—330 metric tpd bleached kraft (for market)

Total production capacity:
(for Northwood Pulp and James Maclaren facilities—Noranda's share)

PULP	
Kraft	1,055 metric tpd
Groundwood	380 metric tpd
Sulfite	118 metric tpd
Total	1,553 metric tpd
PAPER	
Newsprint	430 metric tpd

Ontario Paper Co. Ltd.

8th floor, 80 King St.
St. Catharines, Ont. L2R 7G2
John E. Houghton, president/chief executive officer

(Ontario Paper Co. Ltd. and its wholly-owned subsidiary, Q.N.S. Paper Co. Ltd., are both owned by the Chicago-based Tribune Co.)

Net sales (U.S.$)	
1983	$337,533,000
1982	267,346,000

About 85% of Ontario's total sales are derived from newsprint, and 90% from exports.

Production of newsprint in 1983 by the two mills was 608,173 metric tons.

Capital expenditures in 1983 were C$15,114,000, and were planned to be $19,969,000 in 1984.

Production facilities:

THOROLD, ONT.
Pulp—355 metric tpd thermomechanical, 186 tpd chemimechanical, 215 tpd deinked news, 190 tpd unbleached sulfite
Newsprint and groundwood specialties—850 metric tpd

BAIE COMEAU, QUE.
(Q.N.S. Paper Co. Ltd.)
Pulp—980 metric tpd groundwood, 225 tpd Opco pulp (Ontario Paper-developed sodium-sulfite-treated TMP), 325 tpd sulfite
Newsprint—1,200 metric tpd

Total production capacity:

PULP	
Groundwood	980 metric tpd
TMP	355 metric tpd
CMP	186 metric tpd
Opco pulp	225 metric tpd
Unbleached sulfite	515 metric tpd
Deinked news	215 metric tpd
Total	2,476 metric tpd
PAPER	
Newsprint and groundwood specialties	2,180 metric tpd

Owens-Illinois Inc.

One Seagate
Toledo, Ohio 43666
Ronald J. Glick, vice president (O-I), general manager of Forest Products Group

Sales of O-I's Forest Products Group in 1983 were $721,400,000 (21% of O-I corporate total). Operations of the group in 1983 and 1983 were "marginally profitable."

In 1984, O-I reorganized its operations into Packaging Operations and Diversified Operations. The Forest Products Group is part of Diversified operations and includes paper mills and box operations in U.S., Mexico and France. O-I is reputed to be the largest producer of corrugating medium in the U.S., and sixth-largest producer of linerboard.

Production of pulp at O-I mills in 1983 was 1,280,545 tons, and paperboard output was 1,300,381 tons.

Capital spending was $15 million in 1983 and is expected to be $40.7 million in 1984 (for mills only, not including woodlands).

The O-I Forest Products Group owns 961,721 acres of timberland and has harvesting rights on 135,488 acres, for a total of 1,117,269 acres.

Production facilities:

VALDOSTA, GA.
(Forest Products Group)
Pulp—920 tpd kraft
Linerboard—850 tpd

GRANGE, TEXAS
(Forest Products Group)
Pulp—1,175 tpd kraft
Linerboard—1,120 tpd

BIG ISLAND, VA.
(Forest Products Group)
Pulp—580 tpd semichemical
Corrugating medium—630 tpd

TOMAHAWK, WIS.
(Forest Products Group)
Pulp—900 tpd semichemical
Corrugating medium—1,090 tpd

Total production capacity:

PULP		
Kraft	2,095 tpd	
Semichemical	1,480 tpd	
Total		3,575 tpd
PAPERBOARD		
Linerboard	1,970 tpd	
Corrugating medium	1,720 tpd	
Total		3,690 tpd

Packaging Corp. of America

1603 Orrington Ave.
Evanston, Ill. 60204
Monte R. Haymon, president/chief executive officer

(Subsidiary of Tenneco Inc.)

Net sales:	
1983	$651,000,000
1982	610,000,000
Pretax income:	
1983	42,000,000
1982	32,000,000

Sales of paperboard pulp and converted products account for 95% of PCA sales.

Production of paperboard at RCA mills in 1983 totaled 1,074,400 tons; pulp output was 682,900 tons.

Capital spending in 1983 at PCA facilities was $46,200,000, with $42,000,000 to be spent in 1984.

In late 1983, PCA acquired some assets of Diamond International Corp.'s molded fiber products division, including molded pulp plants in Red Bluff, Calif., and Plattsburgh, N.Y. Also in 1983 PCA sold its 120-tpd recycled board mill at Delaware Water Gap, Pa., to a new firm, Stroudsberg Paperboard Co., and two recycled board mills (at Denver, Colo., and Hutchinson, Kan.) were sold to Republic Gypsum Co.

PCA's timberland holdings comprise 418,000 acres owned and 128,000 acres controlled, for total of 546,000 acres, all in U.S.

Production facilities:

RED BLUFF, CALIF.
Molded pulp products

MACON, GA.
Molded pulp products

GRIFFITH, IND.
Molded pulp products

TAMA, IOWA
Combination (recycled) board—100 tpd

FILER CITY, MICH.
Pulp—610 tpd semichemical
Corrugating medium—720 tpd

PLATTSBURGH, N.Y.
Molded pulp products

RITTMAN, OHIO
Combination (recycled) board—460 tpd

COUNCE, TENN.
(Tennessee River Pulp & Paper Co.)
Pulp—1,600 tpd kraft
Linerboard—1,720 tpd

Total production capacity:

PULP		
Kraft	1,600 tpd	
Semichemical	610 tpd	
Total		2,210 tpd
PAPERBOARD		
Combination (recycled) board	560 tpd	
Corrugating medium	720 tpd	
Linerboard	1,720 tpd	
Total		3,000 tpd

Parsons & Whittemore Inc.

200 Park Ave.
New York, N.Y. 10017
James S. Hayes, president

Financial data not available.

Production facilities:

CLAIBORNE, ALA.
(Alabama River Pulp Co.)
Pulp—1,000 tpd bleached kraft (for market)

NACKAWIC, N.B.
(St. Anne-Nackawic Pulp & Paper Co. Ltd.)
Pulp—660 metric tpd bleached hardwood kraft (for market)

Total production capacity:

PULP	1,727 short tpd

Pentair Inc.

1700 W. Highway 36
St. Paul, Minn. 55113
D. Eugene Nugent, president/chief executive officer

(Wholly-owned subsidiaries are Niagara of Wisconsin Paper Corp., Miami Paper Corp., Flambeau Paper Corp. and Port Huron Paper Corp.)

Net sales:	
1983	$319,289,000
1982	271,085,000
Net earnings:	
1983	11,916,000
1982	10,510,000

Sales of paper represent about 82% of Pentair's total. Port Huron Paper Corp. was acquired in October 1983, and its activities are only partially reflected in 1983 data.

Production of paper at the Pentair mills in 1983 was approximately 430,000 tons.

Sales by Niagara of Wisconsin in 1983 were $104,009,000; shipments were 180,000 tons of publication papers. Capital improvements at this mill in 1983 were $8,400,000.

Sales by Miami Paper in 1983 were $57,408,000; shipments were 89,000 tons of publishing, commercial and technical/converting grades. Capital improvements were $2,500,000.

Sales by Flambeau Paper in 1983 totaled $75,386,000; shipments were 106,000 tons of fine paper. Capital investments were $4,800,000.

Port Huron Paper was acquired in October 1983; its sales and shipments would represent only a brief term under Pentair ownership.

Pentair's total capital investments in 1983 were $42,730,000; expected spending in 1984 was set at $50,000,000.

Production facilities:

DETROIT, MICH.
(Port Huron Paper Corp.)
Packaging/specialty paper—160 tpd

PORT HURON, MICH.
(Port Huron Paper Corp.)
Business/printing papers—200 tpd

WEST CARROLLTON, OHIO
(Miami Paper Corp.)
Pulp—100 tpd deinked
Printing/publication paper—600 tpd

NIAGARA, WIS.
(Niagara of Wisconsin Paper Corp.)
Pulp—200 tpd groundwood
Printing/publication paper—600 tpd

PARK FALLS, WIS.
(Flambeau Paper Co.)
Pulp—120 tpd sulfite
Fine papers—340 tpd

Total production capacity:

PULP		
Deinked	100 tpd	
Groundwood	200 tpd	
Sulfite	120 tpd	
Total		420 tpd
PAPER		
Printing/publication	1,200 tpd	
Fine paper	340 tpd	
Packaging/specialty papers	160 tpd	
Total		1,700 tpd

Pope & Talbot Inc.

1500 SW First Ave
Portland, Ore 97201
Peter T. Pope, chairman/chief executive officer

Net sales:	
1983	$287,684,000
1982	257,715,000
Net earnings:	
1983	10,887,000
1982	4,327,000

Pope & Talbot has been in the wood products business since its founding 135 years ago; in recent years it has diversified from the timber side into pulp (1978) and into consumer tissue (1980). In 1983, nearly half of P & T's revenues were generated by sales of tissue and pulp.

P & T acquired a 50% equity in the Halsey pulp mill in 1978, and acquired the remaining half in 1983. Acquisition of the Absorbent Products operations—two tissue mills in Wisconsin—from Brown Co. in 1980 was made with the realization that substantial capital spending would be required to realize their full potential. Through 1983, P & T has spent $32.4 million on these facilities. Capital commitments at end-1983 of $10.9 million were principally committed to continued expansion at the Wisconsin tissue mills, product quality upgrade at the Halsey pulp mill, and cost-savings projects at Canadian sawmills.

Production facilities:

HALSEY, ORE
(Pope & Talbot Pulp Inc.)
Pulp—450 tpd bleached softwood and hardwood kraft (one-third for market)

EAU CLAIRE, WIS
(Absorbent Products Div.)
Pulp—300 tpd deinking
Paper—200 tpd tissue & towel

LADYSMITH, WIS
(Absorbent Products Div.)
Paper—75 tpd tissue & wadding

Total production capacity

PULP		
Bleached kraft	450 tpd	
Deinked	300 tpd	
Total		750 tpd
PAPER		
Tissue	275 tpd	

Potlatch Corp.

One Maritime Plaza
San Francisco, Calif. 94111
Richard B. Madden, chairman/chief executive officer

Net sales:	
1983	$906,745,000
1982	820,180,000
Net earnings:	
1983	40,467,000
1982	22,533,000

Approximately 70% of Potlatch sales are derived from pulp, paper/board and converted products. In 1983, bleached kraft pulp and paperboard accounted for sales of $258,456,000; printing/writing papers were $210,575,000; tissue was $109,163,000; liquid-tight containers $56,944,000.

Production of bleached kraft pulp in 1983 was 743,136 tons; output of bleached paperboard was 522,190 tons; printing/writing paper was 222,928 tons, and tissue 127,520 tons (a total of 872,638 tons of paper and board grades).

Capital spending in 1983 was $54,200,000, and $55,000,000 is scheduled for 1984. Major capital ventures are expected to be limited, but two are being planned—expansion of premium-coated paper production in Minnesota, and a modernization program for the pulp/paperboard division in Idaho.

Potlatch owns 1,418,000 acres of timberland in U.S.

Production facilities:

McGEHEE, ARK
(Cypress Bend Pulp Mill)
Pulp—535 tpd bleached kraft (small amount for market)
Bleached paperboard—565 tpd

LEWISTON, IDAHO
(Paperboard Div.)
Pulp—1,100 tpd bleached kraft (some for market)
Bleached paperboard—905 tpd

LEWISTON, IDAHO
(Consumer Products Div.)
Tissue—245 tpd

BRAINERD, MINN
(Northwest Paper Div.)
Printing/business paper—410 tpd

CLOQUET, MINN
(Northwest Paper Div.)
Pulp—485 tpd bleached kraft
Printing/business paper—605 tpd

RANSOM, PA
(Consumer Products Div.)
Pulp—135 tpd deinked
Tissue—125 tpd

Total production capacity:

PULP		
Bleached kraft	2,120 tpd	
Deinked pulp	135 tpd	
Total		2,255 tpd
PAPER & BOARD		
Printing/business paper	1,015 tpd	
Paperboard	1,470 tpd	
Tissue	370 tpd	
Total		2,855 tpd

Prince Albert Pulp Co. Ltd.

410 22nd Street East
Saskatoon, Sask. S7K 5T7
R. Donnelly, director/chief operating officer

Production facilities:

PRINCE ALBERT, SASK
Pulp—900 metric tpd bleached kraft (for market)

Total production capacity:

PULP	900 metric tpd

Procter & Gamble Co.

Box 599
Cincinnati, Ohio 45201
James M. Edwards, vice president, Paper Products Div.
Robert E. Cannon, group vice president, Cellulose Operations

(Wholly-owned subsidiaries are Procter & Gamble Paper Products Co., Buckeye Cellulose Corp., Procter & Gamble Cellulose Ltd.)

Financial data for P&G's papermaking operations are not available.

Production facilities:

OXNARD, CALIF
(Procter & Gamble Paper)
Tissue grades

FOLEY, FLA
(Buckeye Cellulose Corp.)
Pulp—1,335 tpd dissolving and paper-grade kraft

ALBANY, GA.
(Procter & Gamble Paper)
Tissue grades

OGLETHORPE, GA.
(Buckeye Cellulose Corp.)
Pulp—860 tpd bleached kraft (for market)

CHEBOYGAN, MICH.
(Procter & Gamble Paper)
Tissue grades

MEHOOPANY, PA.
(Procter & Gamble Paper)
Pulp—sulfite
Tissue grades

MEMPHIS, TENN.
(Buckeye Cellulose Corp.)
Pulp—265 tpd cotton linter

GREEN BAY, WIS.
(Procter & Gamble Paper)
Pulp—sulfite
Tissue grades

GRANDE PRAIRIE, ALTA.
(Procter & Gamble Cellulose)
Pulp—850 metric tpd bleached kraft (for market)

Total production capacity:

PULP (short tons)	
Cotton linter	265 tpd
Kraft	3,130 tpd
Sulfite	n.a.
Total	3,395 tpd
PAPER	
Tissue	(est. 2,570 tpd)

Publishers Paper Co.

4000 Kruse Way Place
Lake Oswego, Ore. 07034
G. Webb Ross, president/chief executive officer

(Publishers is the Newsprint and Forest Products subsidiary of Times Mirror Co.)

Net sales:	
1983	$356,100,000
1982	258,500,000
Operating profit:	
1983	−9,500,000
1982	−11,600,000

Newsprint sales, of $219,100,000, accounted for 62% of Publishers' revenue in 1983, which was 38% above the 1982 figure. Operating loss was down 18% from 1982, but was also the fourth consecutive year of losses for Publishers' operations. (A one-time charge of $5,100,000 related to closure of the sulfite pulp operation at the Oregon City mill and a $1,400,000 cost to release the company from some Oregon state timber-cutting contracts were major contributors to the 1983 operating loss.)

Production of newsprint at Publishers' two mills was 538,000 tons in 1983, up 6.1% from 1982.

Publishers continues to emphasize use of waste newspaper as a fiber source; more than 180,000 tons were recyled during 1983. In midyear, Publishers acquired Independent Paper Stock Co., the West's largest wastepaper dealer and broker.

Production facilities:

NEWBERG, ORE.
(Newberg Div.)
Pulp—250 tpd sulfite 500 tpd TMP, 175 tpd refiner mechanical, 475 tpd deinked (by mid-84)
Newsprint—1,000 tpd

OREGON CITY, ORE.
Pulp—300 tpd TMP, 135 tpd RMP, 300 tpd deinked
Newsprint—650 tpd

Total production capacity:

PULP	
Sulfite	250 tpd
Refiner mechanical	310 tpd
Thermomechanical	800 tpd
Deinked	775 tpd
Total	2,135 tpd
PAPER	
Newsprint	1,650 tpd

Reed Paper Ltd.

145 King St. W.
Toronto, Ont. M5H 1J8
J. Peter Williams, president/chief executive officer

(Approximately 87% of Reed Paper shares are held by Reed Paper Holdings, Ltd., a subsidiary of Reed International Ltd. of U.K.)

Financial data not available.

In the fiscal year ending April 1, 1984, Reed's Quebec mill operated at 97% capacity, with the only downtime being for modernization of one paper machine.

This machine rebuild project is the first phase of a C$100,000,000 program to modernize all four paper machines and support facilities in the Quebec mill. Completion target for the program is 1986.

Production facilities:

QUEBEC CITY, QUE.
Pulp—680 metric tpd groundwood, 450 tpd sulfite (140 tpd for market).)
Newsprint—910 metric tpd
Paperboard—90 metric tpd

Total production capacity:

PULP	
Groundwood	680 metric tpd
Sulfite	450 metric tpd
Total	1,130 metric tpd
PAPER & BOARD	1,000 metric tpd

Repap Enterprises Inc.

1155 Dorchester Blvd. W.
Montreal, Que. H3B 2H9
George S. Petty, chairman/chief executive officer

Repap Enterprises is a majority shareholder in MN Holdings, Inc., which owns Midtec Paper Corp., and Nitec Paper Corp. in U.S. In addition, Repap owns Acadia Forest Products Ltd. in New Brunswick, and in late August 1984 agreed to purchase from Boise Cascade the 500-metric-tpd kraft market pulp mill at Newcastle, N.B.

Financial data not available.

Midtec Paper suffered operating losses in 1982 and early 1983, but in fall 1983 the mill returned to profitable operation.

In 1982, the Nitec mill was shut down and the company has been seeking reorganization under Chapter XI.

Production facilities:

NIAGARA FALLS, N.Y.
(Nitec Paper Corp.)
(Mill idled in mid-1982)
Pulp—80 tpd groundwood, 120 tpd deinked
Printing paper—230 tpd
Cellulose wadding & tissue—120 tpd

KIMBERLY, WIS.
(Midtec Paper Corp.)
Pulp—185 tpd groundwood
Coated printing, specialty paper—920 tpd

NELSON-MIRAMICHI, N.B.
(Acadia Forest Products Ltd.)
Pulp—355 metric tpd bleached and unbleached groundwood market pulp

NEWCASTLE, N.B.
(former Boise Cascade mill)
Pulp—500 metric tpd bleached and unbleached kraft market pulp

Active production capacity:

PULP (metric tons)	
Groundwood	523 metric tpd
Kraft	500 metric tpd
Total	1,023 metric tpd
PAPER (metric tons)	
Coated groundwood	835 metric tpd

St. Joe Paper Co.

803 First National Bank Bldg.
Jacksonville, Fla. 32456
J.C. Belin, chairman/president/chief executive officer

St. Joe is a privately owned company; financial data not available.

A five-year energy-conservation program, which also will increase linerboard capacity by 54,000 tpy, was due for completion in second half of 1984.

Production in 1983 was 386,092 tons of linerboard.

Capital expenditures in 1983 were $7,000,000; budget for 1984 spending is $12,000,000.

Production facilities:

PORT ST. JOE, FLA.
Pulp—1,700 tpd kraft
Unbleached kraft linerboard—1,200 tpd*

Total production capacity:

PULP	1,700 tpd
PAPERBOARD	1,200 tpd*

*Will be 1,350 tpd in 1985.

St. Regis Corp.

In mid-1984, St. Regis accepted a buyout offer from Champion International; merger was consummated in late 1984. See Champion International listing.

Scott Paper Co.

Scott Plaza
Philadelphia, Pa. 19113
Phillip E. Lippincott, chairman/chief executive officer

(Scott has a 50% share in the joint-venture Brunswick Pulp & Paper Co.; Brunswick in turn has a 26% interest in British Columbia Forest Products Ltd. Scott Maritimes Ltd. is a wholly-owned subsidiary of Scott Paper International Inc., a wholly-owned subsidiary of Scott Paper Co.

Net sales:	
1983	$2,465,088,000
1982	2,293,426,000
Net earnings:	
1983	123,679,000
1982	74,457,000

Scott's sales in 1983 rose to record level, up 7% from 1982. Sales from domestic operations ($140,125,000) were also an all-time high; and net income rose 66%. Scott's share of the earnings of its international affiliates also rose very sharply—to $26,600,000, compared to a loss of $39,800,000 in 1982.

Since 1981 start of its $1.6-billion, 5-year capital investment program, designed to improve profitability in "core" businesses, Scott has spent nearly $1 billion, including $221,000,000 in 1983. Latest (and largest single investment in Scott's history) is the $300,000,000 modernization of the energy complex at the Mobile, Ala., mill, due for completion in late 1985. Capital expenditures for 1984 and 1985 are expected to total about $750,000,000.

The Packaged Products sanitary paper business recorded its highest earnings in 1983, up 18% over 1982; sales of $1,500,000,000 also set a record. S.D. Warren paper operations increased its operating income 46% over 1982, and sales of $667,000,000 were another record. In the Natural Resources Div., unit sales of market pulp posted a 17% increase, but recorded a loss due to depressed prices for market pulp plus a 9-month strike at the Maritimes pulp mill in Nova Scotia.

Scott owns 3,060,000 acres of timberlands in U.S. and Canada.

Production facilities:
(Scott does not release capacity data, information below is estimated and incomplete)

MOBILE, ALA.
(S.D. Warren Div.)
Pulp—1,400 tpd kraft, also deinked
Tissue—750 tpd
Other paper grades (mainly printing/writing)—800 tpd

BRUNSWICK, GA
(Brunswick Pulp & Paper)
Pulp—1,700 tpd kraft (1300 tpd for market) (Scott's share: 850 tpd)
Bleached paperboard—400 tpd (Scott's share: 200 tpd)

SKOWHEGAN, MAINE
(S.D. Warren Div.)
Pulp—800 tpd bleached kraft (some for market)
Paper—600 tpd coated free-sheet

WESTBROOK, MAINE
(S.D. Warren Div.)
Pulp—295 tpd bleached kraft
Coated printing and specialty papers—550 tpd

WINSLOW, MAINE
(S.D. Warren Div.)
Pulp—sulfite **(pulp mill idle)**
Paper—600 tpd tissue, toweling, waxing, coating-base, specialty

MUSKEGON, MICH.
(S.D. Warren Div.)
Pulp—230 tpd bleached kraft
Coated printing and specialty papers—400 tpd

FORT EDWARD, N.Y.
Tissue—180 tpd

CHESTER, PA
Tissue—1,060 tpd

EVERETT, WASH.
(Northwest Operations)
Pulp—650 tpd sulfite (some for market)
Tissue, towel—600 tpd

MARINETTE, WIS.
Tissue—350 tpd

OCONTO FALLS, WIS.
(Mill idled 1982)

NEW WESTMINSTER, B.C.
(Scott Paper Ltd.)
Pulp—63 metric tpd groundwood
Tissue—245 metric tpd

ABERCROMBIE POINT, N.S.
(Scott Maritimes Pulp)
Pulp—540 metric tpd bleached kraft (for market)

CRABTREE, QUE.
(Scott Paper Ltd., Eastern Mfg. Div.)
Pulp—90 metric tpd deinked
Tissue—159 metric tpd

LENNOXVILLE, QUE.
(Scott Paper Ltd., Eastern Mfg. Div.)
Pulp—45 metric tpd deinked
Tissue—45 metric tpd

Total production capacity (estimated):

PULP (short tons)		
Kraft		4,175 tpd
Sulfite		650 tpd
Groundwood		70 tpd
Deinked		150 tpd
Total	5,045 tpd	
PAPER & BOARD (short tons)		
Tissue grades		3,436 tpd
Printing/writing		800 tpd
Coated papers		1,550 tpd
Bleached paperboard		200 tpd
Total	5,986 tpd	

Simpson Paper Co.

One Post St.
San Francisco, Calif. 94104
John Fannon, president

(Wholly-owned subsidiary of Simpson Timber Co.)

Financial data not available.

In late 1982, Simpson agreed to purchase the 50% interest of its partner, Crown Zellerbach Corp., in the Crown Simpson Pulp Co. market pulp mill at Fairhaven, Calif.

In late 1983, Simpson bought the Harding-Jones rag-content paper mill in Middletown, Ohio.

Production facilities:

ANDERSON, CALIF.
Pulp—125 tpd kraft (some for market)
Printing/writing paper—350 tpd

FAIRHAVEN, CALIF.
(Crown Simpson Co.)
Pulp—640 tpd bleached kraft (for market)

POMONA, CALIF.
Pulp—50 tpd deinked
Printing/writing paper—310 tpd

RIPON, CALIF.
Pulp—20 tpd deinked
Printing/writing paper—85 tpd

VICKSBURG, MICH.
Fine papers—80 tpd
Special industrial paper—20 tpd

MIDDLETOWN, OHIO
(former Harding-Jones Paper Co.)
Pulp—5 tpd cotton-content
Rag-content paper—25 tpd

MIQUON, PA.
Fine papers—125 tpd

Total production capacity:

PULP		
Kraft		765 tpd
Deinked		70 tpd
Cotton-content		5 tpd
Total	840 tpd	
PAPER		
Printing/writing		745 tpd
Fine paper		205 tpd
Rag-content paper		25 tpd
Total	995 tpd	

Jefferson Smurfit Corp.

401 Alton St.
Alton, Ill. 62002
Michael W.J. Smurfit, chairman/chief executive officer

(Subsidiary of Jefferson Smurfit Group Ltd.)

Net sales:	
1983	$599,884,000
1982	318,240,000
Net earnings:	
1983	10,144,000
1982	9,892,000

Until late 1983, Jefferson Smurfit Corp. was a holding company (subsidiary of Jefferson Smurfit Group Ltd., of Ireland), with its principal subsidiaries including Alton Packaging Corp., Smurfit Diamond Packaging, and Smurfit Industries Inc. At yearend, Alton Packaging, Smurfit Diamond and Smurfit Industries were merged into Jefferson Smurfit Corp. and all operations were consolidated.

JSC's operations comprise the four mills of the former Alton Packaging (Jacksonville, Fla., linerboard mill and three recycled board plants at Cedartown, Ga., Alton, Ill., and Lafayette, Ind.), Smurfit Industries (recycled board mill at Monroe, Mich.), and two Smurfit Diamond Packaging recycled boxboard mills (Lockland and Middletown, Ohio).

Earnings in 1983 of JSC were 100% from paperboard sales. Capital expenditures were $35,500,000.

Production facilities:

JACKSONVILLE, FLA.
Pulp—725 tpd unbleached kraft
Kraft linerboard—850 tpd

CEDARTOWN, GA.
Tube stock—50 tpd

ALTON, ILL.
Recycled corrugating medium—600 tpd

LAFAYETTE, IND.
Tube stock, chipboard—100 tpd

MONROE, MICH.
(Smurfit Paperboard)
Tube stock, chipboard—125 tpd

LOCKLAND, OHIO
Recycled boxboard—272 tpd

Total production capacity:

PULP		725 tpd
PAPER & BOARD		
Kraft linerboard		850 tpd
Recycled medium		600 tpd
Recycled boxboard		545 tpd
Tube stock, chipboard		275 tpd
Total	2,270 tpd	

Sonoco Products Co.

North Second St.
Hartsville, S.C. 29550
Charles W. Coker, Jr., president/chief executive officer

Net sales:	
1983	$668,628,000
1982	538,617,000
Net earnings:	
1983	32,534,000
1982	28,587,000

In Dec. 1982, Sonoco acquired most of the assets of the Composite Can Div. of Container Corp. of America. In mid-198 Sonoco shut down the St. Lawrence Pulp & Paper Corp. deinked pulp mill at Ogdensburg, N.Y., and sold it to Ponderosa Fibres of America in early 1984.

Sales of paperboard and converted products comprise 70% of Sonoco's revenues. Production of paperboard in 1983 was 598,876 tons; pulp output was 33,351 tons.

Capital expenditures in 1983 were $32,919,000 and were expected to be $45,000,000 in 1984.

Sonoco owns 18,000 acres of timberland and controls an additional 22,000 acres.

Production facilities:

CITY OF INDUSTRY, CALIF.
Paperboard—65 tpd

RICHMOND, CALIF.
(Mill idled 3/84)

ATLANTA, GA.
Paperboard—112 tpd

ROCKTON, ILL.
Paperboard—62 tpd

HOLYOKE, MASS.
Paperboard—231 tpd

AMSTERDAM, N.Y.
Paperboard—60 tpd

LANCASTER, OHIO
Paperboard—73 tpd

MUNROE FALLS, OHIO
Paperboard—69 tpd

DOWNINGTOWN, PA.
Paperboard—170 tpd

HARTSVILLE, S.C.
Pulp—200 tpd semichemical
Corrugating medium—516 tpd
Paperboard—550 tpd

NEWPORT, TENN.
Paperboard—229 tpd

SUMNER, WASH.
Paperboard—72 tpd

BRANTFORD, ONT.
(Sonoco Ltd.)
Paperboard—130 metric tpd (143 short tons)

TERREBONNE, QUE.
(Sonoco Ltd.)
Paperboard—55 metric tpd (60 short tons)

Total production capacity:

PULP (short tons)	300 tpd

PAPERBOARD (short tons)		
Paperboard	1,896 tpd	
Corrugating medium	516 tpd	
Total		2,412 tpd

Southwest Forest Industries Inc.

Box 7548
Phoenix, Ariz. 85011
W.A. Franke, president/chief executive officer

Net sales:	
1983	$636,415,000
1982	534,008,000
Net earnings:	
1983	-24,696,000
1982	-27,389,000

Despite a 19% increase in sales volume in 1983, it was the second consecutive year Southwest recorded a loss (of which nearly 60% was a loss from nonrecurring charges and from discontinued operations). Sales of pulp, newsprint, linerboard, and shipping containers in 1983 were $327,320,000, a 6% rise from 1982, but depressed markets, particularly in western U.S., resulted in an operating loss for SFI's Paper Products Div. of $3,988,000. Sales of pulp, paper and paperboard accounted for 51% of 1983 sales.

Production of newsprint and linerboard at SFI mills in 1983 was 509,000 tons. Bleached kraft market pulp output was 223,000 tons.

Capital expenditures (companywide) were $23 million in 1983 and $40.5 million was expected to be spent in 1984.

Southwest owns in fee or has cutting rights on 600,000 acres of private timberland, and also harvests under contracts with USFS and others.

Production facilities:

SNOWFLAKE, ARIZ.
Pulp—700 tpd kraft, 180 tpd groundwood, 550 tpd deinked news
Newsprint—780 tpd
Kraft linerboard—420 tpd

PANAMA CITY, FLA.
Pulp—1450 tpd kraft (650 tpd bleached for market)
Linerboard—828 tpd

Total production capacity:

PULP		
Kraft	2,150 tpd	
Groundwood	180 tpd	
Deinked news	550 tpd	
Total		2,880 tpd

PAPER & BOARD		
Newsprint	780 tpd	
Kraft linerboard	1,248 tpd	
Total		2,028 tpd

Stone Container Corp.

360 N. Michigan Ave.
Chicago, Ill. 60601
Roger W. Stone, chairman/chief executive officer

Net sales:	
1983	$655,847,000
1982	426,639,000
Net earnings:	
1983	-2,922,000
1982	14,185,000

In 1983, Stone Container completed the most important acquisition in its history—three containerboard/kraft specialty board mills from Continental Forest Industries, which virtually doubled the size of Stone's operations. Results of operations for the acquired locations are included from Oct. 7, 1983. Proforma combined sales for 1983 would be $1,055,000,000.

In mid-1984, Stone agreed to sell its recycled board mills at Franklin, Ohio, and Mobile, Ala., to Newark Group Inc., and in turn acquired Newark's recycled medium mill at Uncasville, Conn.

Production of paper and paperboard in 1983 was 1,194,000 tons, with 767,000 tons converted. Proforma combined production for 1983 would be 2,125,100 tons, of which 1,148,900 is unbleached kraft linerboard; 385,900 tons semichemical corrugating medium; 487,500 tons unbleached kraft paper; and 102,800 tons recycled boxboard.

Acquisition of the Continental Forest Brown System Operations, at a cost of approximately $510,000,000, was the major expenditure by Stone in 1983. In addition, the company purchased the remaining 50% equity in Dean-Dempsey Corp., a lumber/woodchip producer.

Capital expenditures for existing facilities was $21,000,000 in 1983; spending in 1984 has been budgeted at $34,000,000. With the substantial capacity of the Confor operations, Stone was not planning major expenditure projects.

Production facilities:

UNCASVILLE, CONN.
(former Newark Group mill)
Recycled corrugating medium—200 tpd

PORT WENTWORTH, GA.
Pulp—800 tpd unbleached kraft
Linerboard and unbleached kraft specialty boards—950 tpd

HODGE, LA.
Pulp—1,400 tpd unbleached kraft, 300 tpd semichemical
Packaging and kraft papers—1,450 tpd
Corrugating medium—365 tpd

COSHOCTON, OHIO
Pulp—600 tpd semichemical
Corrugating medium—800 tpd

HOPEWELL, VA.
Pulp—1,000 tpd unbleached kraft
Linerboard and unbleached kraft specialty boards—1,145 tpd

FLORENCE, S.C.
(South Carolina Industries)
Pulp—1,400 tpd
Linerboard and unbleached kraft specialty boards—1,750 tpd

Total production capacity:

PULP		
Unbleached kraft	4,600 tpd	
Semichemical	900 tpd	
Total		5,500 tpd

PAPER & BOARD		
Packaging/kraft papers	1,450 tpd	
Linerboard/kraft specialty	3,845 tpd	
Corrugating medium	1,365 tpd	
Total		6,660 tpd

Stora Kopparberg North America

Newton Falls, N.Y. 13666
Ralph C. Keef, vice president, North America Div., Stora Kopparberg

Stora Kopparberg Group of Sweden was a participent in the joint venture that established Nova Scotia Pulp Mill in 1959 and for some has been sole owner of what has been renamed Nova Scotia Forest Industries.

In spring 1984, Stora entered the U.S. industry through acquisition of Newton Falls Paper Mills Inc.

Financial data is not available.

Production facilities:

NEWTON FALLS, N.Y.
(Newton Falls Paper Co.)
Pulp—140 tpd deinked
Printing/writing paper—400 tpd

POINT TUPPER, N.S.
(Nova Scotia Forest Industries)
Pulp—454 metric tpd bleached sulfite (for market); 109 tpd high-yield sulfite; 381 tpd groundwood
Newsprint—454 metric tpd

Total production capacity:

PULP (short tons)		
Sulfite	500 tpd	
High-yield sulfite	120 tpd	
Groundwood	420 tpd	
Deinked	140 tpd	
Total		1,180 tpd

PAPER (short tons)		
Newsprint	500 tpd	
Printing/writing	400 tpd	
Total		900 tpd

Temple-Inland Inc.

303 South Temple Drive
Diboll, Texas 75941
Clifford J. Grum, president/chief executive officer of Temple-Inland Inc.
Clinton G. Ames Jr., executive vice president of Temple-Inland Inc.; president/chief executive officer of Inland Container Corp.
Joe C. Denman Jr., executive vice president of Temple-Inland Inc.; chairman/president/chief executive officer of Temple-Eastex Inc.

(Temple-Eastex Inc. and Inland Container Corp. are wholly-owned subsidiaries. of Temple-Inland Inc.; Inland has 50% share in Georgia Kraft Co.)

Temple-Inland total revenues in 1983 were $1,175,546,000, of which Inland accounted for 51% and Temple-Eastex was 22%.

Container/containerboard (Inland)

Revenues:	
1983	$597,000,000
1982	577,000,000
Income:*	
1983	21,000,000
1982	30,000,000

Pulp/paperboard (Temple-Eastex)

Revenues:	
1983	$253,000,000
1982	255,000,000
Income:*	
1983	20,000,000
1982	21,000,000

*Business segment income.

Temple-Inland Inc. became an independent company Jan. 1, 1984, following spinoff by Time Inc. of its forest products operations. An important first step of the new firm was to proceed with plans for a new 175,000-tpy recycled containerboard mill in Ontario, Calif. Startup is planned for late 1985.

Inland Container shipped 1,172,000 tons of corrugated boxes in 1983. Most of the linerboard is supplied by Georgia Kraft while Inland mills make the medium; including GK's output, Inland produced about 1,226,000 tons of containerboard in 1983.

At Temple-Eastex, 1983 production was 449,000 tons of paperboard and 89,000 tons of market pulp.

Timberlands include 1,100,000 acres owned by Temple-Eastex plus half of 1,200,000 acres owned and leased by Georgia Kraft.

Production facilities:

NEWARK, CALIF.
(Inland Container)
Recycled paperboard—175 tpd

KRANNERT and MACON, GA;
MAHRT, ALA.
(Georgia Kraft Co.)
Pulp—3,900 tpd unbleached kraft (Inland's 50% is 1,950 tpd)
Linerboard—4,400 tpd (Inland's 50% is 2,200 tpd)

NEWPORT, IND.
(Inland Container)
Recycled paperboard—525 tpd

NEW JOHNSONVILLE, TENN.
(Inland Container)
Pulp—375 tpd semichemical
Corrugating medium—525 tpd

DIBOLL, TEXAS
(Temple-Eastex, Building Products)
Pulp—500 tpd defibrated
Fiberboard—1,200,000 ft^2/day

EVADALE, TEXAS
(Temple-Eastex, Pulp/Paperboard)
Pulp—1,500 tpd bleached kraft
Bleached board and market pulp—1,500 tpd

Total production capacity:

PULP		
Kraft		3,450 tpd
Semichemical		375 tpd
Defibrated		500 tpd
Total	4,325 tpd	
PAPERBOARD		
Bleached board		1,500 tpd
Linerboard		2,200 tpd
Corrugating medium		1,225 tpd
Total	4,925 tpd	
BUILDING BOARD		
Fiberboard		1,200,000 ft^2/day

Union Camp Corp.

1600 Valley Rd.
Wayne, N.J. 07470
Peter J. McLaughlin, president/chief executive officer

Net sales:	
1983	$1,688,254,000
1982	1,436,051,000
Net earnings:	
1983	132,736,000
1982	124,021,000*

* Extraordinary charge

Sales in 1983 for Union Camp rose 18% above those in 1982, and income was up by 7%. Total paper product shipments of 2,193,000 tons represent a nearly 10% increase over 1982. Shipments of kraft paper/board were 541,859 tons and of fine paper/board 658,315 tons; shipments of converted paper products were 992,867 tons.

Capital spending totaled a record $411,000,000 (80% for pulp/paper projects) in 1983 and was estimated to be $325,000,000 (70% pulp/paper) in 1984. The major project is the 600-tpd integrated bleached pulp/fine paper mill being built at Eastover, S.C., for startup in fall 1984.

Union Camp owns 1,643,000 acres of timberland and has cutting rights on 95,000 acres, for a total of 1,738,000 acres in six southeastern states.

Production facilities:

MONTGOMERY, ALA.
Pulp—2,200 tpd kraft
Linerboard—2,050 tpd

SAVANNAH, GA.
Pulp—2,900 tpd kraft
Linerboard—1,600 tpd
Unbleached paper—1,200 tpd

MONROE, MICH.
Recycled paperboard—200 tpd

EASTOVER, S.C.
(greenfield mill; startup 9/84)
Pulp—700 tpd bleached kraft
Uncoated free-sheet paper—600 tpd

FRANKLIN, VA.
Pulp—1,950 tpd kraft
Fine & industrial papers, board—1,900 tpd

Total production capacity:

PULP		7,750 tpd
PAPER & BOARD		
Unbleached paper		1,200 tpd
Fine & industrial, paper/board		1,900 tpd
Linerboard		3,650 tpd
Recycled board		200 tpd
Uncoated free-sheet		600 tpd
Total	7,550 tpd	

United States Gypsum Co.

101 S. Wacker Dr.
Chicago, Ill. 60606
Edward W. Duffy, chairman

Gypsum linerboard is included in U.S. Gypsum's Gypsum Products operations, which accounted for 52% ($843,569,000) of 1983 sales; insulation board is part of Wood Fiber & Mineral Fiber operations, accounting for 11% ($177,837,000) of 1983 sales. Contributions to operating profit were 86% for Gypsum Products and 10% for Wood Fiber & Mineral Fiber operations.

In May 1984, the merger of Masonite Corp. into U.S. Gypsum was completed. The "paper" production capacity for U.S. Gypsum is unchanged by this acquisition, since Masonite had closed or sold its roofing felt mills.

Production facilities:

SOUTH GATE, CALIF.
Gypsum board liner—200 tpd
Saturating felt—70 tpd **(idle)**

JACKSONVILLE, FLA.
Gypsum board liner—250 tpd

LISBON FALLS, MAINE
Pulp—130 tpd defibrated
Insulation board—384,000 ft²/day (est. 130 tpd)

NORTH KANSAS CITY, MO.
Gypsum board liner—130 tpd

CAMDEN, N.J.
Gypsum board liner—100 tpd

CLARK, N.J.
Gypsum board liner—390 tpd

OAKFIELD, N.Y.
Gypsum board liner—130 tpd

GYPSUM, OHIO
Gypsum board liner—110 tpd

PILOT ROCK, ORE.
Pulp—150 tpd defibrated
Insulation board—150 tpd

OAKMONT, PA.
(Mill idle)

GALENA PARK, TEXAS
Gypsum board liner—150 tpd

JOLIETTE, QUE.
(Canadian Gypsum Co. Ltd.)
Roofing, deadening felt—104 metric tpd

Total production capacity:

PULP	280 tpd
PAPER & BOARD	
Gypsum board liner	1,460 tpd
Insulation board	280 tpd
Roofing, deadening felt	115 metric tpd
Total	1,855 tpd

Virginia Fibre Corp.

51 Locust Ave.
New Canaan, Conn. 06840
R.C. Macauley, president/chief executive officer

Financial data not available.

Production of corrugating medium in 1983 was 216,808 tons; output of semichemical pulp was 177,145 tons.

Capital spending in 1983 was $378,000 and $2,667,000 is expected to be spent in 1984. Plans include a 40-tpd expansion of medium capacity during 1984.

Virginia Fibre has cutting rights on 2,400 acres of timberland.

Production facilities:

RIVERVILLE, VA.
Pulp—510 tpd semichemical
Corrugating medium—610 tpd

Total production capacity:

PULP	510 tpd
PAPERBOARD	610 tpd

Westar Timber Ltd.

1176 West Georgia St.
Vancouver, B.C. V6E 4B7
John S.R. Montgomery, president

Net sales (C$)	
1983	$338,600,000
1982	247,300,000
Operating profit (C$)	
1983	11,000,000
1982	54,500,000

The name of this subsidiary of B.C. Resources Investment Corp. was changed early in 1984 from BC Timber Ltd. to Westar Timber Ltd.

Poor markets and low prices were the major factors affecting Westar operations in 1982 and 1983. The Celgar Pulp mill followed a strict regimen of productivity improvements and cost reductions in 1983—and set production records for 8 out of the 12 months. The higher operating costs of Skeena Pulp mill kept the Prince Rupert "A" mill closed for part of 1983; "B" mill remained closed for all the year.

Despite this partial shutdown, production at Westar pulp mills in 1983 was 391,000 metric tons, a modest increase from the 388,109 tons produced in 1982.

Production facilities:

CASTLEGAR, B.C.
(Celgar Pulp Div.)
Pulp—500 metric tpd bleached kraft (for market)

PRINCE RUPERT, B.C.
(Skeena Pulp Div.)
Pulp—1,200 metric tpd bleached kraft (for market)

Total production capacity:

PULP	1,700 metric tpd

Western Pulp Limited Partnership

1800—1050 West Pender St.
Vancouver, B.C. V6E 2XE
Ronald K. Rogstad, president/chief executive officer

Western Pulp Limited Partnership was formed in early 1983 for the purpose of acquiring the two market pulp mills of Western Forest Products Ltd. WPLP officially acquired the mills on December 19, 1983; they are operated by WPLP's general partner, Western Pulp Inc.

The operations in 1983 under WPLP, for a few days in December, resulted in an operating loss.

A modernization program at the Squamish mill, which was stopped in early 1982, is being resumed; it is expected to increase capacity by 43% by 1986. A smaller upgrade program at Port Alice is expected to add about 34 metric tpd to capacity, also by 1986.

Production facilities:

PORT ALICE, B.C.
Pulp—430 metric tpd sulfite dissolving (for market)

WOODFIBRE, B.C.
Pulp—475 metric tpd bleached kraft (for market)

Total production capacity:

PULP	905 metric tpd

Westvaco Corp.

299 Park Ave.
New York, N.Y. 10171
David L. Luke III, chairman

Net sales	
1983	$1,493,412,000
1982	1,449,644,000
Net earnings	
1983	62,789,000
1982	63,093,000

Westvaco's sales for fiscal 1983 (ending October 31) were up 3% from 1982, while earnings dropped a miniscule 0.5%. Sales of printing grade papers and boards accounted for 39% of sales in 1983; sales of kraft paper were 10%; sales of envelopes were 10%; sales of corrugated containers and bags were 17%. Primary production of paper, paperboard and market pulp was 2,112,000 tons.

Capital spending in 1983 for bleached pulp, paper and paper products was $92.8 million; for unbleached products $86.8 million.

Since 1962, Westvaco has developed and enacted a series of multi-year growth programs. A new program for 1984-88 is designed to increase papermaking capacity by about 1,300 tpd, or 21% over previous levels, at a cost of $1.6 billion. Details of components of the program are to be announced when products are ready to go to market.

Westvaco owns 1,374,000 acres of timberland in U.S. and Brazil.

Production facilities:

WICKLIFFE, KY.
(Fine Papers Div.)
Pulp—772 tpd bleached kraft
Fine papers—500 tpd

LUKE, MD.
(Fine Papers Div.)
Pulp—866 tpd kraft
Fine papers—1,100 tpd

TYRONE, PA.
(Fine Papers Div.)
Fine papers—184 tpd

CHARLESTON, S.C.
(Kraft Div.)
Pulp—2,435 tpd unbleached kraft
Paperboard—2,250 tpd

COVINGTON, VA.
(Bleached Board Div.)
Pulp—1,568 tpd kraft (bleached 1,376 tpd), 192 tpd semichemical
Paperboard—1,313 tpd
Corrugating medium—312 tpd

Total production capacity:

PULP		
Kraft		5,631 tpd
Semichemical		192 tpd
Total	5,823 tpd	
PAPER & BOARD		
Fine papers		1,784 tpd
Corrugating medium		312 tpd
Paperboard		3,563 tpd
Total	5,659 tpd	

Weyerhaeuser Co.

Tacoma, Wash. 98477
George H. Weyerhaeuser, president/chief executive officer

(Weyerhaeuser Canada Ltd. is a wholly-owned subsidiary; Weyco has 90% of North Pacific Paper Corp. joint venture)

Net sales:	
1983	$4,882,629,000
1982	4,186,224,000
Net earnings:	
1983	204,843,000*
1982	168,992,000*

*Extraordinary charges

Weyerhaeuser is a major building materials producer, and sales of these products in 1983 totaled $2.6 billion. Sales of primary pulp and paper were $1.5 billion ($1.159 billion to outside customers, $335.5 million intersegment). Sales of containers and packaging products to outside customers was $701.5 million; intersegment $31.3 million.

Production of market pulp at six Weyco mills in 1983 was 1,122,000 short tons; 902,000 tons were shipped. Production of newsprint at one mill was 422,000 tons; 434,000 tons were shipped. Other paper grades, produced at four mills, totaled 596,000 tons; 594,000 tons were shipped. Output of paperboard and containerboard at seven mills was 2,101,000 tons; 756,000 tons were shipped. Production of shipping containers consumed 1,160,000 tons; 1,162,000 tons of containers were shipped. Cartons consumed 52,000 tons to produce 53,000 tons of shipped finished product.

Capital spending in 1983 for Weyco's paper operations was $105 million; $60 million for bleached fiber facilities; $45 million for containerboard and cartons.

Weyerhaeuser owns more than 5,900,000 acres of commercial forestland.

Production facilities:

PINE BLUFF, ARK.
Pulp—300 tpd kraft (unbleached)
Bag and sack paper—320 tpd

COLUMBUS, MISS.
Pulp—260 tpd thermomechanical
Lightweight coated paper—500 tpd

NEW BERN, N.C.
Pulp—800 tpd bleached kraft (for market)

PLYMOUTH, N.C.
Pulp—1,480 tpd kraft (some for market), 220 tpd semichemical
Containerboard—1,020 tpd
Fine papers—930 tpd

VALLIANT, OKLA.
Pulp—1,600 tpd kraft, 400 tpd semichemical
Linerboard—1,980 tpd
Corrugating medium—550 tpd

NORTH BEND, ORE.
Pulp—300 tpd semichemical
Corrugating medium—450 tpd

SPRINGFIELD, ORE.
Pulp—1,090 tpd kraft
Containerboard—1,400 tpd

COSMOPOLIS, WASH.
Pulp—450 tpd sulfite (for market)

EVERETT, WASH.
Pulp—395 tpd kraft (for market)

LONGVIEW, WASH.
(Pulp Div., Paperboard Div.)
Pulp—800 tpd kraft, fluff, semichemical (some for market)
Corrugating medium—280 tpd
Bleached paperboard—565 tpd

LONGVIEW, WASH.
(North Pacific Paper Co.)
Pulp—1,450 tpd thermomechanical
Newsprint—1,300 tpd

LONGVIEW, WASH.
(Paper Div.)
Fine paper—290 tpd

ROTHSCHILD, WIS.
Pulp—210 tpd sulfite
Fine paper—320 tpd

KAMLOOPS, B.C.
(Weyerhaeuser Canada Ltd.)
Pulp—1,135 metric tpd kraft (for market)

Total production capacity:

PULP		
Kraft		7,515 tpd
Semichemical		1,120 tpd
Sulfite		660 tpd
Thermomechanical		1,710 tpd
Total	11,005 tpd	
PAPER & BOARD		
Fine paper		1,540 tpd
LWC paper		500 tpd
Newsprint		1,300 tpd
Bag and sack paper		320 tpd
Bleached paperboard		565 tpd
Containerboard		5,680 tpd
Total	9,585 tpd	

Willamette Industries Inc.

3800 First Interstate Tower
1300 SW Fifth Avenue
Portland, Ore. 97201
William Swindells Jr., president/chief executive officer

Net sales:	
1983	$1,045,669,000
1982	928,745,000
Net earnings:	
1983	22,272,000
1982	5,345,000*

*Extraordinary charge

Willamette's Paper Group comprises six paper mills and 25 converting plant. Sales of these operations in 1983 were $685 million, or 66% of corporate total. Contributions to 1983 earnings by the Paper Group were $47 million, 89% of the total.

Willamette has estimated that its 1983 output of 1,140,000 tons accounted for the following percentages of the national output: bleached hardwood market pulp 6.4%; linerboard, bag paper and corrugating medium, 3.7%; corrugated containers 3.4%; kraft grocery bags 7.0%; business forms, 4.4%; and fine paper 1.7%.

Capital spending for Paper Group facilities in 1983 was $30 million.

Willamette owns 557,000 acres of timberland in the West and South.

Production facilities:

PORT HUENEME, CALIF.
Recycled paperboard (corrugating medium, linerboard)—330 tpd

HAWESVILLE, KY.
(Kentucky Mills, Bleached Pulp)
Pulp—620 tpd bleached hardwood kraft (350 tpd for market)
Fine paper—445 tpd

HAWESVILLE, KY.
(Kentucky Mills, Corrugating Medium)
Pulp—300 tpd semichemical
Corrugating medium—350 tpd

CAMPTI, LA.
(Red River Mill Div.)
Pulp—800 tpd unbleached kraft
Kraft linerboard—930 tpd

ALBANY, ORE.
Pulp—580 tpd kraft, 200 tpd semichemical
Kraft linerboard & paper—800 tpd
Corrugating medium—265 tpd

Total production capacity:

PULP	
Kraft	2,000 tpd
Semichemical	500 tpd
Total	2,500 tpd

PAPER & BOARD	
Fine paper	445 tpd
Kraft linerboard & paper	1,730 tpd
Corrugating medium	615 tpd
Recycled linerboard, medium	330 tpd
Total	3,120 tpd

COMPANY PROFILES
All-inclusive industry guide

A listing of all U.S. and Canadian pulp and paper firms; operations are grouped under corporate owner excepting non-paper/board industry owners. Subsidiaries and joint ventures are cross-referenced.

Production capacity data are shown in short tons for U.S. mills and indicated in metric tons for Canadian mills.

APL Corp.
6917 Collins Ave.
Miami Beach, Fla. 33141
Victor Posner, chairman/president/chief executive officer

Production facilities:

FLAGSTAFF, ARIZ.
(Ponderosa Paper Products, Concel Inc.)
Pulp — 80 tpd deinked (est.)
Paper — 50 tpd tissue

PRYOR, OKLA.
([illegible] Tissue Mills Inc.)
Pulp — 125 tpd deinked
Paper — 100 tpd tissue

ST. HELENS, ORE.
(Concel Inc., machine in Boise Cascade mill)
Paper — 125 tpd tissue

Total production capacity:

Pulp	125 tpd deinked
Paper	275 tpd tissue

Abitibi-Price Inc.
SEE "Major firms (1,000 tpd)."

Acadia Forest Products Ltd.
SEE Repap Enterprises Inc. listing in "Major firms (1,000 tpd)."

Alabama Kraft Co.
SEE Mead Corp. and Temple-Inland Inc. listings in "Major firms (1,000 tpd)."

Alabama River Pulp Co.
SEE Parsons & Whittemore Inc. listing in "Major firms (1,000 tpd)."

Alaska Lumber & Pulp Co. Inc.
(Sub. of Alaska Pulp Co. Inc.)
3000 Rainier Bank Tower
Seattle, Wash. 98101
George Ishiyama, president

Production facilities:

SITKA, ALASKA
Pulp — 600 tpd alpha dissolving sulfite (for market)

Allied Materials Corp.
Box 12340
Oklahoma City, Okla. 73157
T.D. Barbour, president

Production facilities:

STROUD, OKLA.
Paperboard — 125 tpd roofing

Allied Paper Inc.
SEE "Major firms (1,000 tpd)."

Alpha Cellulose Corp.
1000 E. Noir St., Box 1306
Lumberton, N.C. 28359
J.E. Wilkinson, president

Production facilities:

Pulp — 1,040 tpd cotton linter, specialty for market

Alton Packaging Corp.
SEE Jefferson Smurfit Corp. listing in "Major firms (1,000 tpd)."

American Fibrit Inc.
(Div. of Deutsch Fibrit, Fed. Rep. Germany)
76 Armstrong Rd.
Battle Creek, Mich. 49015
F. W. Hobbert, president

Production facilities:

Pulp — 33 tpd thermomechanical

American Packaging Corp.
(Interstate Div.)
(Formerly Interstate Folding Box Co.)
300 Verity Parkway
Middletown, Ohio 45042
Steven B. Schottland, president

Production facilities:

MIAMISBURG, OHIO
(Miamisburg Boxboard Div.)
(Mill closed 1982)
Paperboard — 100 tpd recycled specialty board

American Paper Products Co.
2113-31 E. Rush St.
Philadelphia, Pa. 19134
[illegible] Feldman, president

Production facilities:

VINCENNES, IND.
(Vincennes Paper Mill Inc.)
Paperboard — 70 tpd chipboard, kraft paper, newsboard, tube stock, water repellent

LANCASTER, PA.
Paperboard — 50 tpd chipboard, newsboard, specialty board

Total production capacity:

Paperboard	120 tpd

Amricon Corp.
(Kerwin Paper Co. Div., formerly Riverside Paper Corp.)
800 S. Lawe St., Box 179
Appleton, Wis. 54912
Paul H. Groth, president/chief executive officer

Production facilities:

Pulp—30 tpd deinking
Paper—Total 100 tpd: 60 tpd fine papers, 40 tpd special industrial

Appleton Papers Inc.
SEE "Major firms (1,000 tpd)"

Arkansas Kraft Corp.
SEE Green Bay Packaging Inc. listing in "Major firms (1,000 tpd)"

Armstrong World Industries Inc.
Liberty & Charlotte Sts., Box 3001
Lancaster, Pa. 17604
R. L. Jones, chairman/president

Production facilities:

PENSACOLA, FLA.
Building board—Acoustical, construction board

MACON, GA.
Pulp—927 tpd defibrated
Building board—Acoustical, fiberboard insulation, sheathing, wallboard

FULTON, N.Y.
Building board—Flooring felt, gaskets

Total production capacity:

Pulp	927 tpd
Building board	n.a.

Ashuelot Paper Co.
Box 26
Hinsdale, N.H. 03451
Ian Smith, president

Production facilities:

HINSDALE, N.H.
Paper—48 tpd tissue, toweling, creping, wrapping, specialties

PUTNEY, VT.
(Formerly Putney Paper Co.)
Paper—40 tpd tissue, creping, florist

Total production capacity:

Paper	88 tpd

Atlantic Asbestos Corp.
SEE: Red Hook Paper Corp.

Atlantic Packaging Products Ltd.
111 Progress Ave.
Scarborough, Ont. M1P 2Y9
Philip Granovsky, chairman

Production facilities:

Pulp—60 tpd deinking
Paperboard—total 425 tpd: 100 tpd corrugating medium, 265 linerboard, 60 tissue

Atlas Roofing Corp.
Valley Forge Rd., Box 5777
Meridian, Miss.
R. Fredin, president

Production facilities:

Paperboard—100 tpd roofing felt

Augusta Newsprint Co.
SEE Abitibi-Price Inc. listing in "Major firms (1,000 tpd)"

Austell Box Board Corp.
SEE Caraustar Industries Inc. listing in "Major firms (1,000 tpd)"

BC Timber Ltd.
SEE Westar Timber Ltd. listing in "Major firms (1,000 tpd)"

B.J. Fibres
SEE: Ponderosa Fibres of America Group

Badger Paper Mills Inc.
W. Front St., Box 149
Peshtigo, Wis. 54157
E.A. Meyer Jr., chairman

Production facilities:

Pulp—150 tpd bleached sulfite
Paper—Total 140 tpd: 100 tpd fine papers, 40 tpd coarse papers

Baldwinville Products Inc.
SEE: Erving Paper Mills

Banner Fibreboard Co.
Box 390
Wellsburg, W. Va. 26070
F.L. Bush, president

Production facilities:

Paperboard—75 tpd tube stock, specialty boards, mill wrappers

Bato Co. Inc.
SEE "Major firms (1,000 tpd)"

Bear Brand Roofing Inc.
N. First St., Box 176
Bearden, Ark. 71720
J. Crist, president

Production facilities:

Building board—30 tpd roofing

Bear Island Paper Co.
SEE Bato Co. Inc. listing in "Major firms (1,000 tpd)"

Beckett Paper Co.
SEE Hammermill Paper Co. listing in "Major firms (1,000 tpd)"

Belkin Packaging Ltd.
Box 8008
Vancouver, B.C. V6B 4P5
Morris Belkin, president

Production facilities:

BURNABY, B.C.
(Belkin Paperboard)
Paper & board/building board—475 tpd boxboard, corrugating medium, linerboard, roofing felts, gypsum board, building paper/board

TORONTO, ONT.
(Belkin Paperboard)
Paperboard—360 metric tpd coated boxboard, linerboard

MONTREAL, QUE.
(Belkin Paperboard)
Paperboard—90 metric tpd backing, binders board, boxboard, can & core stock, chipboard

Total production capacity:

Paper	45 metric tpd
Paperboard	925 metric tpd

Belkin Paperboard
SEE: Belkin Packaging Ltd.

Beloit Box Board Co. Inc.
801 [illegible] St., Box 386
Beloit, Wis. 53511
[illegible], president/treasurer

Production facilities:

Paperboard — 46 tpd boxboard; [illegible] can & tube stock

Bemis Co. Inc.
800 Northstar Center
Minneapolis, Minn. 55402
Howard J. Curler, president/chief executive officer

Production facilities:

[illegible], ILL.
Paper — [illegible] 60 tpd, 45 tpd multiwall, 15 tpd flour bag stock

Bennett Inc.
2700 Bourgogne St.
Chambly, Que. J3L 4B6
[illegible], president

Production facilities:

Paperboard — 27 metric tpd binders board (packaging, wet machine board) specialties

Bergstrom Paper Co.
SEE: P.H. Glatfelter Co. listing in "Major firms (1,000 tpd)"

Bermico Co.
2100 Northwestern Ave.
West Bend, Wis. 53095

Production facilities:
(Mill closed)

Paperboard — 50 tpd pipe conduit

Beveridge Paper Co.
SEE: Simkins Industries Inc.

Bio-Tech
Battenville, N.Y.
(Box 29, Greenwich, N.Y. 12834)
Marvin [illegible], president/general manager

Production facilities:

Paper — 15 tpd tissue

Bird Inc.
Washington Street
East Walpole, Mass. 02032
[illegible], chairman/president/chief executive officer

Production facilities:

SHREVEPORT, LA.
Roofing, siding and deadening felt — 235 tpd

PORTLAND, ORE.
Roofing felt — 28 tpd

Total production capacity:

Roofing felt 263 tpd

Blandin Paper Co.
SEE: B.C. Forest Products Ltd. listing in "Major firms (1,000 tpd)"

Boise Cascade Corp.
SEE: "Major firms (1,000 tpd)"

Boise Southern Co.
SEE: Boise Cascade Corp. listing in "Major firms (1,000 tpd)"

Bowater Inc.
SEE: "Major firms (1,000 tpd)"

Bowater Carolina Co., Bowater Southern Paper Co., Bowater Mersey Paper Co.
SEE: Bowater Inc. listing in "Major firms (1,000 tpd)"

Brandywine Paper Mills Inc.
131 Wallace Ave.
Downingtown, Pa. 19335
Robert M. McIlvain, president

Production facilities:

Paper & board — 50 tpd chipboard specialties

British Columbia Forest Products Ltd.
SEE: BCFP and Mead Corp. listing in "Major firms (1,000 tpd)"

Brown Products Inc.
One Pine St.
Nashua, N.H. 03060
[illegible] Barrett, chairman

Production facilities:

Paperboard — 6 tpd corrugating medium

Brownville Paper Co.
SEE: [illegible] Corp.

Brunswick Pulp & Paper Co.
SEE: Mead Corp. and Scott Paper Co. listings in "Major firms (1,000 tpd)"

Buckeye Cellulose Corp.
SEE: Procter & Gamble Co. listing in "Major firms (1,000 tpd)"

Building Products of Canada Ltd.
(Building Materials Div.
of Imperial Oil Ltd.)
10500 Côte de Liesse
Lachine, Que. H8T 1A3
[illegible], president

Production facilities:

EDMONTON, ALTA.
Building board — 80 metric tpd gypsum fiberboard, roofing felt

WINNIPEG, MAN.
Building board — 80 metric tpd roofing felt

LASALLE, QUE.
Building board — 100 metric tpd roofing felt, sheathing

PONT ROUGE, QUE.
Building board — 180 metric tpd acoustical, asphalt, insulation board, roofing felt

Total production capacity:

Building board — 480 metric tpd

Burrows Paper Corp.
501 W. Main St.
Little Falls, N.Y. 13365
Ralph W. Burrows, chairman/chief executive officer

Production facilities:

PICKENS, MISS.
(Burrows Southern Corp.)
Paper – 20 tpd carbonizing, napkin, pattern, wrapping, specialty tissue

LITTLE FALLS, N.Y.
Paper – 40 tpd carbonizing, napkin, pattern, wrapping, specialty tissue

LITTLE FALLS, N.Y.
(Mohawk Valley Paper Co.)
Paper – 40 tpd carbonizing, napkin, pattern, wrapping, specialty tissue

LYONSDALE, N.Y.
(Lyonsdale Div.)
Paper – 40 tpd carbonizing, napkin, pattern, wrapping, specialty tissue

Total production capacity:

Paper	140 tpd

Burrows Southern Corp.
SEE: Burrows Paper Corp.

Byron Weston Co.
SEE: Crane & Co. Inc.

CIP Inc.
SEE: "Major firms (1,000 tpd)"

CKF Inc.
SEE: Minas Basin Pulp & Power Co. Ltd.

CPM Inc.
131 Sullivan St.
Claremont, N.H. 03743
Harvey D. Hill, president

Production facilities:

CLAREMONT, N.H.
Paper – 70 tpd special & industrial

EAST RYEGATE, VT
([illegible] Co. Inc.)
Paper – 60 tpd special & industrial

Total production capacity:

Paper	130 tpd

California Paperboard Corp.
SEE: Newark Group Inc. listing in "Major firms (1,000) tpd".

Canadian Cellulose Co. Ltd.
SEE: BC Timber listing in "Major firms (1,000 tpd)."

Canfor Corp.
SEE: "Major firms (1,000 tpd)".

Canadian Gypsum Co. Ltd.
SEE: United States Gypsum Co. listing in "Major firms (1,000 tpd)."

Canadian International Paper Co.
SEE: CIP Inc. listing in "Major firms (1,000 tpd)."

Caraustar Industries Inc.
SEE: "Major firms (1,000 tpd)

Cariboo Pulp & Paper Co.
SEE: Champion International Corp. listing in "Major firms (1,000 tpd)."

Carolina Paperboard Corp.
SEE: Caraustar Industries Inc. listing in "Major firms (1,000 tpd)."

Carotell Paper Board Corp.
SEE: Caraustar Industries Inc. listing in "Major firms (1,000 tpd)."

Cascades Inc.
SEE: "Major firms (1,000 tpd)

Cascades (East Angus) Inc.,
Cascades (Jonquiere) Inc.
SEE: Cascades Inc. listing in "Major firms (1,000 tpd)."

Catawba Newsprint Co.
SEE: Bowater Inc. listing in "Major firms (1,000 tpd)."

Cellu Tissue Corp.
(Former Cellu-Products Co. mill)
2 Forbes St.
East Hartford, Conn. 06108

Production facilities:

Paper – 60 tpd absorbent tissue, wadding

Cellu-Products Co.
(Div. of Sealed Air Corp.)
Box 96, [illegible] Rd.
Patterson, N.C. 28661
J. W. [illegible], president, general manager

Production facilities:

PATTERSON, N.C.
Paper – 70 tpd tissue, wadding

Cellulo Co.
SEE: [illegible]

Celotex Corp.
SEE: "Major firms (1,000 tpd)"

CertainTeed Corp.
Box 860
Valley Forge, Pa. 19482
Michael L. [illegible], president [illegible]

Production facilities:

SHAKOPEE, MINN.
Pulp – 60 tpd defibrated
Construction papers – 200 tpd building felt

[illegible]
Pulp – 75 tpd refiner mechanical defibrated
Construction papers – 90 tpd building felt

Total production capacity:

Pulp	135 tpd
Building board	290 tpd

Chagrin Fibers Inc.
100 Remington Ave.
Norfolk, N.Y. 13667

Bought by Hamilton Hybar Inc. in 1984.

Production facilities:

NORFOLK, N.Y.
(Norfolk Div.)
Paper – 65 tpd pattern, specialty tissue

Champion International Corp.
SEE: "Major firms (1,000 tpd)."

Chase Bag Co.
2 Greenwich Plaza
Greenwich, Conn. 06830
F.H. Ludington Jr., chairman

Production facilities:

CHAGRIN FALLS, OHIO
(Paper Mill Div.)
Paper — 62 tpd bag and sack, filter, toweling, specialties.

Chattanooga Paperboard Corp.
SEE Caraustar Industries Inc. listing in "Major firms (1,000 tpd)."

Cheney Pulp & Paper Co.
Anderson St.
Franklin, Ohio 45005
E.H. Bindley, chairman

Production facilities:

Pulp — 18 tpd linen, rag, jute, hemp.

Chesapeake Corp.
SEE "Major firms (1,000 tpd)."

Chesapeake Paperboard Co.
Fort Ave. & Woodall Sts.
Baltimore, Md. 21230
C.J. Smith, president

Production facilities:

Paperboard — 250 tpd boxboard, chipboard.

Chicago Paperboard Corp.
SEE Caraustar Industries Inc. listing in "Major firms (1,000 tpd)."

Cincinnati Paperboard Corp.
SEE Caraustar Industries Inc. listing in "Major firms (1,000 tpd)."

Cleaners Hanger Co.
670 17th St., N.W.
Massillon, Ohio 44646
Dennis Mele, president

Production facilities:

Paperboard — 70 tpd chipboard, containerboard.

Clevepak Corp.
100 Main St.
Piermont, N.Y. 10968

Production facilities:

PIERMONT, N.Y.
(Mill idle)

Paperboard — 185 tpd chipboard, boxboard, laminating.

Clifton Paperboard Co. Inc.
(Former Whippany Paper Board Co. mill)
1 Ackerman Ave.
Clifton, N.J. 07011
Dominick [illegible], president

Production facilities:

Paperboard — 200 tpd setup, bending chip, and folding carton.
Paperboard — 150 tpd recycled linerboard and roofing felt (November 1984 startup).

Climax Mfg. Co.
Castorland, N.Y. 13620
Charles S. Hirschey, chairman

Production facilities:

CARTHAGE, N.Y.
(Paperboard Div.)
Paperboard — 125 tpd boxboard, binders board, chipboard, foodboard, specialties.

Colonial Fiber Co.
SEE Lydall Inc.

Columbia Corp.
Box 330
Chatham, N.Y. 12037
James L. Salerno, president/treasurer

Production facilities:

CHATHAM, N.Y.
Paperboard — 90 tpd binders board, boxboard, chipboard, fiberboard, specialty.

NORTH HOOSICK, N.Y.
Paperboard — 100 tpd boxboard, specialty board.

Total production capacity:

Paperboard	190 tpd

Concel Inc.
SEE APL Corp.

Congoleum Corp.
(Resilient Flooring Div.)
195 Belgrove Dr.
Kearny, N.J. 07032
H.F. Pearson, president

Production facilities:

FINKSBURG, MD.
Pulp — 45 tpd mechanical.
Building board — 350 tpd flooring felt, roofing, sheathing.

Connecticut Paperboard Corp.
SEE Newark Group Inc. listing in "Major firms (1,000 tpd)."

Connelly Containers Inc. of Philadelphia
(Sub. of Connelly Containers Inc.)
4,908 Main St.
Philadelphia, Pa. 19127
J. Donahue, president

Production facilities:

Paperboard — 125 tpd corrugating medium.

Consolidated-Bathurst Inc.
SEE "Major firms (1,000 tpd)."

Consolidated Packaging Corp.
325 N. Wells St., Suite 4000
Chicago, Ill. 60610
Joseph L. Gidwitz, chairman/chief executive officer

Company filed for protection under Chapter 11 of the federal bankruptcy law in June 1984. Expects to continue as a "somewhat streamlined" company.

Production facilities:

FORT MADISON, IOWA
Pulp — 150 tpd semichemical.
Paperboard — 200 tpd corrugating medium.

Consolidated Papers Inc.
SEE "Major firms (1,000 tpd)."

Container Corp. of America
SEE "Major firms (1,000 tpd)."

Continental Forest Industries
SEE "Major firms (1,000 tpd)."

Contoocook Valley Paper Co.

Box 528
West Henniker, N.H. 03242
Frederic H. Fletcher, president/treasurer

Production facilities:

Paperboard—20 tpd latex paper & board, shoeboard, specialties

Conwed Corp.

P.O. Box 64237
St. Paul, Minn. 55164
Frederick T. Weyerhaeuser, president

Production facilities:

CLOQUET, MINN.
Building board—68 ESF/hr dry-felted wood blankets

RIVERSIDE, N.J.
Building board—75 tpd dry-felted wood blankets

Cornwall Paper Mills Co.

51 S. Jefferson St.
Orange, N.J. 07050
Thomas G. San Giacomo, chief executive officer

Production facilities:

CORNWALL, N.Y.
Paperboard—200 tpd corrugating medium

Corrugated Services Inc.

On Interstate 20
Forney, Texas 75126
Jones Felvey, president

Production facilities:

Paperboard—130 tpd corrugating medium

Cottrell Paper Co. Inc.

Rock City Falls, N.Y. 12863
J. Thomas Cottrell Jr., president

Production facilities:

FORT MILLER, N.Y.
(Fort Miller Div.)
Pulp—3 tpd rag
(Mill idle)

ROCK CITY FALLS, N.Y.
(Rock City Falls Mill)
Paperboard—6 tpd electrical insulating

Coy Paper Co.

Claremont, N.H. 03743
Hans Orlander-Schann, president

Production facilities:

Paper—19 tpd pattern, twisting tissue

Crane & Co. Inc.

30 South St.
Dalton, Mass. 01226
B. J. Sullivan, president/chief executive officer

Production facilities:

DALTON, MASS.
(Bay State Mill)
Paper—20 tpd banknote, bond, papeterie, wedding bristols & papers

DALTON, MASS.
(Byron Weston Co.)
Paper—50 tpd bond, bristols, business forms, fine paper, printing/writing, specialties

DALTON, MASS.
(Old Berkshire Mill)
Paper—3.5 tpd carbonizing tissue

DALTON, MASS.
(Pioneer Mill)
Paper—20 tpd fine papers, banknote, bond

DALTON, MASS.
(Wahconah Mill)
Paper—40 tpd printing & publication, banknote

Total production capacity:

Paper 133.5 tpd

Crestbrook Forest Industries Ltd.

(Pulp Div.)
(60% owned by Honshu and Mitsubishi of Japan)
Box 4600
Cranbrook, B.C. V1C 4J7
Akira Shibunuma, chairman/chief executive officer

Production facilities:

SKOOKUMCHUCK, B.C.
Pulp—525 metric tpd kraft (for market)

Crocker Technical Papers Inc.

431 Westminster St.
Fitchburg, Mass. 01420
Richard P. Cummale, chairman/president

Production facilities:

Paper—25 tpd capacitor, electrical insulating

Crown Forest Industries Ltd.

SEE "Major firms (1,000 tpd)"

Crown Paper Board Co. Inc.

Delaware Ave. & Tasker St.
Philadelphia, Pa. 19148
Jesse L. Sievers, president/general manager

Production facilities:

Paperboard—85 tpd boxboard, chipboard, [illegible]

Crown Simpson Co.

SEE Simpson Paper Co. listing in "Major firms (1,000) tpd"

Crown Zellerbach

SEE "Major firms (1,000 tpd)"

Crystal Tissue Co.

3120 S. Verity Pkwy.
Middletown, Ohio 45042-0449
William Seymour III, chairman/president/chief executive officer

Production facilities:

Paper—80 tpd fiber specialty tissue

Davey Co.

164 Laidlaw Ave.
Jersey City, N.J. 07306
W. A. Dodd, chairman/secretary

Production facilities:

AURORA, ILL.
(Aurora Paperboard Div.)
Paperboard—100 tpd binders board, cover fiberboard, mill boards

JERSEY CITY, N.J.
(Jersey City Mill)
Paperboard—100 tpd specialty board, binders board, mill boards, wet machine board

DOWNINGTOWN, PA.
Paperboard—70 tpd binders board, specialty board-template board

Total production capacity:

Paperboard 270 tpd

Deerfield Specialty Papers
(Affiliate of Reed Intl. Inc., U.K.)
45 William St.
Wellesley, Mass. 02181
N.W. Baldrachi, president

Production facilities:

AUGUSTA, GA.
Paper — 55 tpd glassine, greaseproof

MONROE BRIDGE, MASS.
Paper — 45 tpd glassine, greaseproof, laminating, waxing

QUEBEC CITY, QUE.
(Glassine Canada Inc.)
Paper — 33 metric tpd glassine, greaseproof, laminating, specialty

Total production capacity:

Paper 133 tpd

Desencrage Cascades Inc.
SEE: Cascades Inc. listing in "Major firms (1,000 tpd)"

Dexter Corp.
(C.H. Dexter Div.)
2 Elm St.
Windsor Locks, Conn. 06096
David L. Coffin, chairman/chief executive officer

Production facilities:

Pulp — 60 tpd hemp
Paper — 65 tpd capacitor, condenser, filter, specialty

Doeskin Inc.
SEE: Statler Tissue Co.

Dominion Cellulose Ltd.
SEE: CIP Inc. listing in "Major firms (1,000 tpd)"

Domtar Inc.
SEE: "Major firms (1,000 tpd)"

Domtar Gypsum America Inc.
SEE: Domtar Inc. listing in "Major firms (1,000 tpd)"

Donohue Inc.
SEE: "Major firms (1,000 tpd)"

Donohue Normick Inc.
SEE: Donohue Inc. listing in "Major firms (1,000 tpd)"

Donohue St-Felicien Inc.
SEE: Donohue Inc. and B.C. Forest Products Ltd. listings in "Major firms (1,000 tpd)"

Dunn Paper Co.
(Sub. of Dennison Mfg. Co.)
218 Riverview St.
Port Huron, Mich. 48060
R.E. Hubbard, president/chief executive officer

Production facilities:

PORT HURON, MICH.
Paper — 125 tpd carbonizing, creping, laminating

WIGGINS, MISS.
Paper — 55 tpd carbonizing

Total production capacity:

Paper — 180 tpd

Durham Mill Inc.
(Former mill of Whippany Paper Board)
Box 158, Rte. 611 & 212
Riegelsville, Pa. 18077
Lawrence Perkins, chairman

Production facilities:

Paperboard — 375 tpd linerboard, specialty

E.B. Eddy Forest Products Ltd.
SEE: Eddy Paper Co. Ltd. listing in "Major firms (1,000 tpd)"

EHV-Weidmann Industries Inc.
(Sub. of Elcon Inc.)
Box 278
Saint Johnsbury, Vt. 05819
Gordon P. Mills, president

Production facilities:

Paperboard — 60 tpd electrical insulation

Eastern Fine Paper Inc.
SEE: Eddy Paper Co. Ltd. listing in "Major firms (1,000 tpd)"

Eastman Kodak Co.
(Kodak Park Div.)
1669 Lake Avenue
Rochester, N.Y. 14650
W.W. Cook, vice president/general manager

Production facilities:

Paper — photographic base paper

Eaton-Dikeman
SEE: Filtration Science Corp.

Ebanite Fiber Corp.
1175 S.E. Crystal Lake Dr.
Corvallis, Ore. 97333
Peter H. Koehler, group president

Production facilities:

Pulp — 120 tpd defibrated [illegible] available for market
Paperboard — 15 tpd special insulation

Eddy Paper Co. Ltd.
SEE: "Major firms (1,000 tpd)"

Elk Corp.
(Sub. of Elcor Corp.)
Box 37
Stephens, Ark. 71764
Roy E. Campbell, chairman

Production facilities:

Building board — 95 tpd roofing felt

Equitable Bag Co. Inc.
45-50 Van Dam St.
Long Island City, N.Y. 11101
Leonard E. Cannio, chairman/chief executive officer

Production facilities:

ORANGE, TEXAS
(Southern Div.)
Paper — 87 tpd bag

Erving Paper Mills
1 Arch Street
Erving, Mass. 01344
Charles B. Housen, president

Production facilities:

BALDWINVILLE, MASS.
(Baldwinville Products Inc.)
Paper — 120 tpd toweling

ERVING, MASS.
(Erving Mill)
Pulp—100 tpd deinking
Paper—110 tpd napkin tissue

HINSDALE, N.H.
(Hinsdale Products Co. Inc.)
Pulp—35 tpd deinking
Paper—Total 75 tpd: 25 tpd tissue; 50 tpd toweling

LOCKLAND, OHIO
(Fox Paper Inc.)
Paper—Total 100 tpd: 70 tpd coarse; 30 tpd tissue

Total production capacity:

Pulp	135 tpd
Paper	405 tpd

Escanaba Paper Co.
SEE Mead Corp. listing in "Major firms (1,000 tpd)."

Esleeck Mfg. Co. Inc.
Canal St.
Turners Falls, Mass. 01376
William C. Blanker, president

Production facilities:

Pulp—rag
Paper—15 tpd thin, technical specialty, saturating-base papers

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Eurocan Pulp & Paper Co. Ltd.
SEE "Major firms (1,000 tpd)."

Evans Products Co.
SEE Ebonite Fiber Corp.

Evers Paper Co.
2160 Erie St.
Utica, N.Y. 13503
Frank E. Evers, president

Production facilities:

UTICA, N.Y.
(former Foster Paper Co. Inc.)
Combination paperboard—24-50 pt. file folders, waterproof, specialty

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Exton Paper Manufacturers Inc.
Box 158, Meredith Rd.
Modena, Pa. 19358
Robert E. Davis, vice president/general manager

Production facilities:

EXTON, PA.
Paper—20 tpd tissue, cellulose wadding

MODENA, PA.
(Valley Mill)
Paper—50 tpd kraft bag, wrapping

Total production capacity:

Paper	70 tpd

FSC Paper Corp.
SEE Garden State Paper listing in "Major firms (1,000 tpd)."

Federal Paper Board Co. Inc.
SEE "Major firms (1,000 tpd)."

Fibre Form Corp.
722 S. Main Street
Columbia City, Ind. 46725
R. M. Brennan, president

Production facilities:

Molded pulp

Filter Materials Inc.
1400 Ware St., Box 329
Waupaca, Wis. 54981
John H. Gosmer, president/general manager

Production facilities:

FRESNO, CALIF.
(Cellulo Co.)
Paper & board—filter, industrial

WAUPACA, WIS.
(Waupaca Mill)
Paper & board—10 tpd specialty board, felt, filter, saturating

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Filtration Science Corp.
105 W. 45th St.
Chattanooga, Tenn. 37409
Edward A. Leese, president/chief executive officer

Production facilities:

MADISONVILLE, KY.
(Southern Specialty Div.)
Paper—40 tpd special industrial, filter

WATERTOWN, N.Y.
(Eaton-Dikeman Div.)
Paper—20 tpd special industrial, filter, photographic base

MOUNT HOLLY SPRINGS, PA.
(Eaton-Dikeman Div.)
Paper—12 tpd special industrial filter, specialty

CHATTANOOGA, TENN.
(Southern Cellulose Products Inc.)
Pulp—85 tpd cotton linter (for market)

CHATTANOOGA, TENN.
(Southern Specialty Paper Co.)
Paper—15 tpd special industrial, blotting, coating base, filter

Total production capacity:

Paper	172 tpd

Finch, Pruyn & Co.
1 Glen St.
Glen Falls, N.Y. 12801
Richard J. Carota, president/chief executive officer

Production facilities:

Pulp—380 tpd ammonium base bisulfite
Paper—575 tpd fine papers

Finlay Forest Industries Ltd.
SEE B.C. Forest Products Ltd. and Mead Corp. listings in "Major firms (1,000 tpd)."

Fitchburg Paper Co.
SEE Technographics Inc.

Flambeau Paper Co.
SEE Pentair Inc. listing in "Major firms (1,000 tpd)."

Fletcher Paper Co.
318 Fletcher St.
Alpena, Mich. 49707
Allan M. Fletcher, president

Production facilities:

Paper—85 tpd: lightweight offset 55; machine specialty 30

Flower City Tissue Mills Co.
700 Driving Park Ave., Box 13497
Rochester, N.Y. 14613-0497
W.F. Shafer III, president/general manager

Production facilities:

Paper—20 tpd specialty and wrapping tissue

Fontana Paper Mills Inc.
SEE Lunday-Thagard Oil Co.

J. Ford & Co. Ltd.
Portneuf, Que. G0A 2Y0
J.B. Ford, president

Production facilities:

Paper/board — Total 180 metric tpd kraft board, tape, creping tissue, specialties, roofing felt.

Forest Fiber Products Co.
(Div. of Stimson Lumber Co.)
Box 68
Forest Grove, Ore. 97116
Darrell Schroeder, president

Production facilities:

Pulp — 140 tpd groundwood
Building board — 140 tpd hardboard

Fort Howard Paper Co.
SEE "Major firms (1,000 tpd)."

Fort Orange Paper Co. Inc.
1900 River Rd.
Castleton-on-Hudson, N.Y. 12033
David Little, president

Production facilities:

Paperboard — 110 tpd folding boxboard.

Foster Paper Co. Inc.
SEE Eves Paper Co.

Fox Paper Inc.
SEE Erving Paper Mills.

Fox River Paper Co.
(Div. of Fox Valley Corp.)
200 E. Washington St., Suite 300
Appleton, Wis. 54913
Harold L. Ellsworth, president

Production facilities:

Paper — 90 tpd fine papers, printing/writing, technical, specialty.

Fraser Inc.
SEE Fraser and also Noranda Mines Ltd. listings in "Major firms (1,000 tpd)."

French Paper Co.
Box 729
Niles, Mich. 49120
J. E. French, chairman/chief executive officer

Production facilities:

Paper — 60 tpd fine papers, greeting card, specialty.

Garden State Paper Co. Inc.
SEE "Major firms (1,000 tpd)."

Gaspesia Pulp & Paper Co.
SEE Abitibi-Price Inc. listing in "Major firms (1,000 tpd)."

Genstar Building Materials Co.
580 Decker St.
Irving, Texas 75062
James D. Moran, chairman/chief executive officer

Production facilities:

LITTLE ROCK, ARK.
Building board — 40 tpd roofing felt.

VERNON, CALIF.
Pulp — 30 tpd defibrated
Building board — Total 365 tpd: 180 tpd gypsum linerboard, 185 tpd roofing felt.

CORNELL, WIS.
Pulp — 60 tpd defibrated
Building board — 220 tpd roofing.

Total production capacity:

Pulp	90 tpd
Building board	585 tpd

Georgia-Bonded Fibers Inc.
Rte. 60
Buena Vista, Va. 24416
Hugo N. Surmonte, chairman

Production facilities:

Paperboard — 40 tpd automobile board, backing, gasket, innersole, etc.

Georgia Kraft Co.
SEE Mead Corp. and Temple-Inland Inc. listings in "Major firms (1,000 tpd)."

Georgia-Pacific Corp.
SEE "Major firms (1,000 tpd)."

Gilbert Paper Co.
SEE Mead Corp. listing in "Major firms (1,000 tpd)."

Gilman Paper Co.
SEE "Major firms (1,000 tpd)."

Gold Bond Building Products
SEE National Gypsum Co. listing in "Major firms (1,000 tpd)."

Glassine Canada Inc.
SEE Deerfield Specialty Papers.

P.H. Glatfelter Co.
SEE "Major firms (1,000 tpd)."

Goodson's Manufacturing Corp.
1400 Coastal St.
Blountstown, Fla. 32424
Howard Goodson, president

Production facilities:
(Mill closed)

Pulp — 210 tpd defibrated
Building board — 575,000 ft^2/day insulation board, sheathing.

Gorham Absorbent Tissue Products
SEE James River Corp. listing in "Major firms (1,000 tpd)."

W. R. Grace & Co.
(Polyfibron Div.)
Rte. 60 E
Owensboro, Ky. 42301
L.K. Martin, plant manager

Production facilities:

Paper — 35 tpd absorbent, converting, impregnating, saturating, specialty.

Grays Harbor Paper Co.
SEE ITT Rayonier Inc. & Hammermill Paper Co. listings in "Major firms (1,000) tpd."

Great Lakes Forest Prods. Ltd.
SEE "Major firms (1,000 tpd)"

Great Northern Nekoosa Corp.
SEE "Major firms (1,000 tpd)"

Great Northern Paper
SEE Great Northern Nekoosa Corp. listing in "Major firms (1,000 tpd)"

Great Southern Paper
SEE Great Northern Nekoosa Corp. listing in "Major firms (1,000 tpd)"

Green Bay Packaging Inc.
SEE "Major firms (1,000 tpd)"

Greif Board Corp.
(Sub. of Greif Bros. Corp.)
9420 Warmington St. S.W., Box 553
Massillon, Ohio 44646
William R. Shew, president

Production facilities:

Paperboard—225 tpd chipboard, linerboard

Groveton Paper Board Inc.
SEE James River Corp. listing in "Major firms (1,000 tpd)"

Gulf States Paper Corp.
SEE "Major firms (1,000 tpd)"

Halifax Paper Board Co. Inc.
Roanoke Ave., Box 368
Roanoke Rapids, N.C. 27870
Robert S. McCabe, president

Production facilities:

Paperboard—85 tpd chipboard, laminating, newsboard, etc.

Halltown Paperboard
Box 110
Halltown, W. Va. 25423
C. C. Hammann, president

Production facilities:

Paperboard—200 tpd boxboard, automobile, chipboard, specialty

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Halsey Pulp Co.
SEE Pope & Talbot Inc. listing in "Major firms (1,000 tpd)"

Hammermill Paper Co.
SEE "Major firms (1,000 tpd)"

Harding-Jones Paper Co.
SEE Simpson Paper Co. listing in "Major firms (1,000 tpd)"

Harriman Paperboard Corp.
SEE Lawrence Paperboard Corp.

Haverhill Paperboard Corp.
SEE Newark Group Inc. listing in "Major firms (1,000 tpd)"

Hennepin Paper Co.
SEE St. Regis Corp. listing in "Major firms (1,000 tpd)"

Henry Molded Products Inc.
71 N. 16th St., Box 75
Lebanon, Pa. 17042
Douglas C. Henry, president/treasurer

Production facilities:

Molded pulp—15 tpd

Hercules Inc.
910 Market St.
Wilmington, Del. 19899
W. M. Brown, plant manager

Production facilities:

HOPEWELL, VA.
(Water Soluble Polymers)
Pulp—Total 250 tpd: 150 tpd sheeted chemical cotton; 100 tpd loose chemical cotton

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Hinsdale Products Co. Inc.
SEE Erving Paper Mills

Hoague Sprague Corp.
(Boxboard Div.)
West Hopkinton, N.H. 03283
Richard L. Knapton, general manager
Wilbarth Brand, Director-Manufacturing

Production facilities:

Paperboard—85 tpd boxboard, chipboard, newsboard

Hollingsworth & Vose Co.
112 Washington St.
East Walpole, Mass. 02032
Gordon W. Moran, president

Production facilities:

EAST WALPOLE, MASS.
(East Walpole Mill)
Paper—50 tpd absorbent, insulating, filter, specialties

WEST GROTON, MASS.
Paper—50 tpd special industrial

EASTON, N.Y.
(Easton Mill)
Paper—35 tpd special industrial

GREENWICH, N.Y.
(Bandy Paper Div.)
Paper—15 tpd filter, impregnating

GREENWICH, N.Y.
(Dayton Mill)
Paper—35 tpd filter, impregnating

Total production capacity:

Paper 185 tpd

Homasote Co.
Box 7240
Trenton, N.J. 08628
Irving Fiske, chairman

Production facilities:

Paperboard, building board—325 tpd wallboard, building paper/board, fiberboard insulation, fiberboard

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Howard Paper Mills Inc.
115 Columbia St.
Dayton, Ohio 45407
Lon N. Mohr, president/general manager

Production facilities:

DAYTON, OHIO
Paper—125 tpd fine papers, business forms, copy, specialties

URBANA, OHIO
Paper—80 tpd fine papers, bond, business form, copy, specialties

Total production capacity:

Paper 205 tpd

Huebert Fiberboard Inc.

Box 167, E. Morgan St.
Boonville, Mo. 65233
J. Huebert, president/production manager

Production facilities:

Pulp—60 tpd defibrated
Building board—70 tpd fiberboard: insulation board, sheathing

IKO Industries Ltd.

1603 42nd Ave. S.E.
Calgary, Alta. T2P 2L2
Harry Koschitzky, president

Production facilities:

CALGARY, ALTA.
Building board—45 metric tpd building paper, board: roofing felt, saturating

BRAMPTON, ONT.
Pulp—90 metric tpd defibrated
Building board—100 metric tpd building paper, board: roofing felt, saturating

CHICAGO, ILL.
Paperboard—roofing felt

FRANKLIN, OHIO
Pulp—60 tpd defibrated
Paper—100 tpd roofing

Total production capacity:

Pulp	150 metric tpd
Building board	245 metric tpd

ITT Rayonier Inc.

SEE "Major firms (1,000 tpd)."

Imperial Mfg. Co.

(Sub. of Collins & Aikman)
20646 Mercantile Rd.
Cleveland, Ohio 44122
William D. Armstrong, president, Green Wall Converting Group

Production facilities:

PLATTSBURGH, N.Y.
(Imperial Paper Co.)
Paper—40 tpd coating base: groundwood specialties, specialty

Inland Container Corp.

SEE Temple-Inland Inc. listing in "Major firms (1,000 tpd)."

Inland Empire Co.

3320 N. Argonne
Spokane, Wash. 99212
James P. Cowles, presidegt

Production facilities:

Pulp—200 tpd refiner mechanical
Paper—200 tpd newsprint

International Building Materials Co.

Box 15257
New Orleans, La. 70115
Ray Planche, vicepresident-marketing

Production facilities:

Paper, board—425 tpd asbestos

Intercontinental Pulp Co.

SEE Canfor Corp. listing in "Major firms (1,000 tpd)."

International Paper Co.

SEE "Major firms (1,000 tpd)."

Interstate Folding Box Co.

SEE American Packaging Corp.

Interstate Intercorr Corp.

SEE Interstate Resources Inc. listing in "Major firms (1,000 tpd)."

Interstate Paper Corp.

SEE Interstate Resources Inc. listing in "Major firms (1,000 tpd)."

Interstate Resources Inc.

SEE "Major firms (1,000 tpd)."

Irving Pulp & Paper Ltd.

SEE "Major firms (1,000 tpd)."

Island Paper Mills Ltd.

SEE Fraser Inc. listing in "Major firms (1,000 tpd)."

Jackson Paper Manufacturing Inc.

Box 667
Sylva, N.C. 28779
John B. Bradley, mill manager

Production facilities:

Paperboard—225 tpd corrugating medium

Jacksonville Kraft Paper Co.

SEE "Major firms (1,000 tpd)."

James River Corp.

SEE "Major firms (1,000 tpd)."

James River-Marathon Ltd.

SEE James River Corp. listing in "Major firms (1,000 tpd)."

Jefferson Smurfit Corp.

(Affiliated with Jefferson Smurfit Group Ltd.)
SEE "Major firms (1,000 tpd)."

Jenkins Products Corp.

1297 High St.
Bridgewater, Mass. 02324
Timothy H. Brooks, president

Production facilities:

Paperboard—20 tpd asbestos-base board: chipboard, gasket, printed board

Johns-Manville Corp.

SEE Manville Forest Products Corp. listing in "Major firms (1,000 tpd)."

Keiding Inc.

4549 W. Woolworth Ave.
Milwaukee, Wis. 53218
Donald C. Bohmann, president

Production facilities:

Molded pulp

Keyes Fibre Co.

(Div. of Royal Packaging Industries Van Leer B.V., based in Amstelveen, Holland)
Two Stamford Square, 3003 Summer St.
Stamford, Conn. 06905
M. Walker Rast, president/chief executive officer

Production facilities:

ALBERTVILLE, ALA.
Molded pulp

SACRAMENTO, CALIF.
Molded pulp — 124 tpd

HAMMOND, IND.
Molded pulp

NEW IBERIA, LA.
Molded pulp
(Mill closed June 30, 1980)

SHAWMUT, MAINE
Pulp — 120 tpd bleached groundwood

WATERVILLE, MAINE
Molded pulp

WENATCHEE, WASH.
Molded pulp — 30 tpd

Kieffer Paper Mills Inc.
1220 W. Spring
Brownstown, Ind. 47220
Kieran M. Devery Jr., president

Production facilities:

Paper & board — 130 tpd recycled corrugating medium, impregnating, industrial, specialty

Kimberly-Clark Corp.
SEE "Major firms (1,000 tpd)."

Kingsey-Falls Paper Inc.
SEE Cascades Inc. listing in "Major firms (1,000 tpd)."

Knowlton Brothers Inc.
SEE Filtration Science Corp.

Koppers Co. Inc.
940 River Rd.
North Tonawanda, N.Y. 14120
F. Killion, plant manager

Production facilities:

Building board — 50 tpd roofing felt

Kruger Inc.
SEE "Major firms (1,000 tpd)."

Lake Utopia Paper Ltd.
SEE Irving Pulp & Paper Ltd. listing in "Major firms (1,000 tpd)."

Lawrence Paperboard Corp.
250 Canal St.
Lawrence, Mass. 01842
Russ Van Atta, president

Lawrence and its subsidiary, Harriman Paperboard Corp., filed for protection under Chapter 11 of the Bankruptcy laws in March 1984. The mills continue to operate.

Production facilities:

LAWRENCE, MASS.
Paperboard — 200 tpd recycled clay-coated cylinder board

HARRIMAN, TENN.
(Harriman Paperboard Corp.)
Pulp — 240 tpd semichemical
Paperboard — 270 tpd corrugating medium

Total production capacity:

Pulp	240 tpd
Paperboard	470 tpd

Leaf River Forest Products
SEE Great Northern Nekoosa Corp. listing in "Major firms (1,000 tpd)."

Leatherback Industries Inc.
(Sub. of Hollinee Corp.)
111 Hillcrest Rd., Box 594
Hollister, Calif. 95023
E. A. DiSalvo, president

Production facilities:

HOLLISTER, CALIF.
Building board — 60 tpd roofing felt

ALBUQUERQUE, N.M.
Building board — 20 tpd roofing felt

Total production capacity:

Building board	80 tpd

Leggett & Platt Inc.
Box 415
Maxton, N.C. 28364
Harry M. Corgell Jr., president

Production facilities:

MAXTON, N.C.
(Packaging Div.)
Paper — 35 tpd wadding

Les Industries Cascades Ltee.
SEE Cascades Inc.

Lincoln Paper Co.
300 Bergen Turnpike
Ridgefield Park, N.J. 07660
R. Werner, president

Production facilities:

Paperboard — 125 tpd

Lincoln Pulp & Paper Co. Inc.
SEE Preco Corp.

Linweave Inc.
30 Linweave Dr.
Holyoke, Mass. 01040
Robert H. Besley, president

Production facilities:

Paper — 100 tpd fine papers: bristols, greeting card, offset, papeterie, writing

Little Rapids Corp.
Box 3629, 2273 Larsen Rd.
Green Bay, Wis. 54303
Richard D. Egan, president

Production facilities:

POTSDAM, N.Y.
(Potsdam Paper Mills)
Paper — 130 tpd specialty printing and packaging
(60 tpd tissue planned for 1986)

SHAWANO, WIS.
(Shawano Paper Mills)
Paper — 160 tpd special industrial papers and tissue

Total production capacity:

Paper	290 tpd

Litton Industries Inc.
SEE Technographics Inc.

Longview Fibre Co.
SEE "Major firms (1,000 tpd)."

Los Angeles Paper Box & Board Mills
5959 E. Randolph St.
Los Angeles, Calif. 90040
Wm. H. Kewell Jr., president/secretary/treasurer

Production facilities:

Paperboard—75 tpd boxboard, chipboard

Louisiana-Pacific Corp.
SEE: "Major firms (1,000 tpd)."

Lowe Paper Co.
SEE: Simkins Industries Inc.

Lunday-Thagard Roofing Co.
9301 S. Garfield Ave.
South Gate, Calif. 90280
George Thagard Jr., president

Production facilities:

FONTANA, CALIF.
(Fontana Paper Mills Inc.)
Building board—35 tpd roofing felt

SOUTH GATE, CALIF.
(Lunday-Thagard Roofing Co.)
Building board—35 tpd

Total production capacity:

Building board 70 tpd

Lydall Inc.
1 Colonial Rd.
Manchester, Conn. 06040
Millard H. Pryor Jr., president

In mid-1984 the Lydall & Foulds mill in Manchester, Conn., was put up for sale.

Production facilities:

MANCHESTER, CONN.
(Mill closed 1982)
(Colonial Fiber Co., Composite Materials Div.)
Paperboard—36 tpd gasket, fiberboard, shoeboard

MANCHESTER, CONN.
(Lydall & Foulds)
Paperboard—90 tpd chipboard, newsboard, specialty

ROCHESTER, N.H.
(Technical Papers Div.)
Paper—10 tpd asbestos, creping, filter, specialty

HOOSICK FALLS, N.Y.
(Technical Papers Div., Hoosick Falls Oper.)
Paperboard—30 tpd automobile, binders, insulating, hardboard, specialty

COVINGTON, TENN.
(Composite Materials Div.)
Paper & board—70 tpd fiberboard, shoeboard, specialty

Total production capacity:

Paper & board 200 tpd

James Maclaren Industries Inc.
SEE: Noranda Mines Ltd. listing in "Major firms (1,000 tpd)."

MacMillan Bloedel Ltd.
SEE: "Major firms (1,000 tpd)."

Madison Paper Corp.
(Owned 60% by Myllykoski of Finland, 40% by New York Times Co.)
Box 129
Madison, Maine 04950
Jack E. Chinn, chairman and chief executive officer

Production facilities:

Pulp—380 tpd groundwood
Paper—520 tpd printing & publication uncoated

Herbert Malarkey Roofing Co.
(Paper Div.)
3131 N. Columbia Blvd.
Portland, Ore. 97217
Michael O. Malarkey, president/resident manager

Production facilities:
(Paper mill idle)

Pulp—40 tpd groundwood
Building board—40 tpd building paper/board, roofing, saturating

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Manchester Board & Paper Co.
111 Hull St.
Richmond, Va. 23224
Kenneth Aspinall, president

Production facilities:

Paperboard—105 tpd boxboard, chipboard, manila

Manistique Papers Inc.
(Div. of Field Corp.)
Box 309
Manistique, Mich. 49854
Leif Christensen, vice president/chief operating officer

Production facilities:

Pulp—Total 165 tpd: 90 tpd groundwood, 75 tpd deinked
Paper—200 tpd newsprint, groundwood specialties

Manfor Ltd.
(formerly Manitoba Forestry Resources Ltd.)
Box 2189
The Pas, Man. R9A 1L9
J. B. Sweeney, president/chief executive officer

Production facilities:

Pulp—400 metric tpd unbleached kraft (some for market)
Paper—415 metric tpd extensible, multiwall bag

Manning Paper Co.
SEE: Hammermill Paper Co. listing in "Major firms (1,000 tpd)."

Manville Building Materials Corp.
(Roofing Systems Div.)
424 Liberty Road, Box 1208
Natchez, Miss. 39120

Production facilities:

Insulation board, roofing

Manville Forest Products Corp.
SEE: "Major firms (1,000 tpd)."

Marcal Paper Mills Inc.
1 Market St.
Elmwood Park, N.J. 07407
R. L. Marcalus, president

Production facilities:

MECHANIC FALLS, MAINE
Paper—75 tpd tissue, toweling, wadding

ELMWOOD PARK, N.J.
(Elmwood Park Mill)
Paper—235 tpd tissue

Total production capacity:

Paper 310 tpd

Marlboro Paper Inc.
191 St. Henri St., Box 366
Drummondville, Que. J2B 6W3

Production facilities:

Paper—15 metric tpd toilet tissue

Martisco Paper Co. Inc.
4747 Route 174
Marcellus, N.Y. 13108
Frank Fernandez, president

Production facilities:

Paperboard — 15 tpd bogus

Maryland Paper Box Co.
(Reading-White Hall Paper Board Co.)
4545 Old Annapolis Rd.
Baltimore, Md. 21227
Samuel A. Melton, plant manager

Production facilities:

WHITE HALL, MD.
Paperboard — 40 tpd boxboard, manila board

SINKING SPRING, PA.
Paperboard — 36 tpd chipboard, boxboard

Total production capacity:

Paperboard	76 tpd

Masonite Corp.
SEE: United States Gypsum Corp. listing in "Major firms (1,000 tpd)"

Les Materiaux Cascades Inc.
SEE: Cascades Inc. listing in "Major firms (1,000 tpd)"

McIntyre Bros. Paper Co. Inc.
131 Mill St.
Fayetteville, N.Y. 13066
Fernand D. Fournier, president

Production facilities:

Paper & board: 15 tpd kraft, lightweight wrapping

Mead Corp.
SEE: "Major firms (1,000 tpd)"

Menasha Corp.
Box 367
Neenah, Wis. 54956
D.C. Shepard, president

Production facilities:

OTSEGO, MICH.
Pulp — 375 tpd semichemical
Paperboard — 400 tpd corrugating medium

Menominee Paper Co. Inc.
(Sub. of Bell Fibre Products Corp.)
144 First St.
Menominee, Mich. 49858
Donald Estebo, general manager

Production facilities:

Paper & board — Total 470 tpd: 70 tpd fine papers, 400 tpd paperboard

Merrimac Paper Co. Inc.
9 S. Canal St.
Lawrence, Mass. 01842
Robert J. Van Nostrand, chairman/chief executive officer

Production facilities:

Paper — 85 tpd special industrial, absorbent, bristols, cover, creping, insulating, technical

Miami Paper Corp.
SEE: Pentair Inc. listing in "Major firms (1,000 tpd)"

Michigan Paperboard Corp.
(Sub. of Field Container Corp.)
79 E. Fountain St.
Battle Creek, Mich. 49016
Terry Tiffany, general manager

(Former St. Regis mill; sold in early 1984)

Production facilities:

Paperboard — 175 tpd recycled

Middletown Paperboard Co.
SEE: Newark Group Inc. listing in "Major firms (1,000 tpd)"

Midtec Paper Corp.
SEE: Repap Enterprises Inc. listing in "Major firms (1,000 tpd)"

Millen Industries Inc.
444 Park Ave. South
New York, N.Y. 10016
Milton M. Schulman, president

Production facilities:

GARWOOD, N.J.
(Garwood Paper Div.)
Paperboard — 120 tpd boxboard, chipboard, core & tube stock, wallboard

Millers Falls Paper Co.
(Div. of Strathmore Paper Co.)
SEE: Hammermill Paper Co. listing in "Major firms (1,000 tpd)"

Milton Leather Board Co.
Milton, N.H. 03851
Gordon Dickie, acting general manager

Production facilities:
(Mill closed)
Paperboard — 10 tpd shoeboard

Minas Basin Pulp & Power Co. Ltd.
Prince Street
Hantsport, N.S. B0P 1P0
J.C. Jodrey, president/chairman

Production facilities:

HANTSPORT, N.S.
Pulp — 40 metric tpd groundwood
Paperboard — 100 metric tpd chipboard, containerboard, boxboard, manila board

HANTSPORT, N.S.
(CKF Inc.)
Molded pulp

Mohawk Paper Mills Inc.
465 Saratoga St.
Cohoes, N.Y. 12047
Thomas D. O'Connor, president/chairman

Production facilities:

COHOES, N.Y.
(Cohoes Mill)
Paper — 85 tpd textbook, bristols, specialty technical

WATERFORD, N.Y.
Paper — 100 tpd fine papers: bond, book, bristols, card, drawing, other specialties

Total production capacity:

Paper	185 tpd

Mohawk Pulp Co. Ltd.
Box 542, 1 Hotel de Ville
Riviere-du-Loup, Que. G5R 3Z1
J.L. Marquis, general manager

Production facilities:

CHEMIN DU LAC, QUE.
Pulp — 50 metric tpd unbleached mechanical groundwood (for market)

RIVIERE-DU-LOUP, QUE
Pulp—40 metric tpd mechanical stone groundwood (for market)

Total production capacity:

Pulp	90 metric tpd

Mohawk Valley Paper Co.

SEE Burrows Paper Corp

Monadnock Paper Mills Inc.

Antrim Rd
Bennington, N.H. 03442
Richard G. Verney, president

Production facilities:

Paper—75 tpd art, book, cotton fiber, cover, industrial, technical

Morris Paper Board Co.

177 Third Ave
Paterson, N.J. 07509
B. Lesenger, president

Company filed for reorganization under Chapter 11 of bankruptcy code on Jan. 30, 1984

Production facilities:

Paperboard—110 tpd boxboard, chipboard, kraft paper, newsboard

Mosinee Paper Corp.

Mosinee, Wis. 54455
C. Scholtens, chairman/president/chief executive officer

Production facilities:

MIDDLETOWN, OHIO
(Sorg Paper Co.)
Paper & board—320 tpd fine, printing/writing and specialty papers, tissue, paperboard

MOSINEE, WIS.
Pulp—195 tpd semibleached kraft
Paper—250 tpd kraft, MG and MF papers

Total production capacity:

Pulp	195 tpd
Paper	570 tpd

Mountain Paper Products Corp.

Facility now being operated as TLR Corp. (see listing)

NBIP Ltd.

SEE CIP Inc. listing in "Major firms (1,000 tpd)"

NVF Co.

Box 68
Yorklyn, Del. 19736
V. Posner, chairman

Production facilities:

NEWARK, DEL.
Paper—16 tpd for vulcanized fiber

YORKLYN, DEL.
(Marshall Bros. Mill)
(Mill idle)
Paper—14 tpd for vulcanized fiber

YORKLYN, DEL.
(Yorklyn Mill)
Paper & board—20 tpd insulation board, trunk board, vulcanized fiber

HOLYOKE, MASS.
(Parsons Paper)
Paper—25 tpd fine papers: art, cotton fiber, impregnating, onionskin, technical, specialty

Total production capacity:

Paper	75 tpd

Nabisco Inc.

East Hanover, N.J. 07936
Robert M. Schaeberle, chairman

Production facilities:

MARSEILLES, ILL.
(Nabisco Brands Inc.)
Paperboard—250 tpd cracker shell, folding boxboard, machine coated

Natick Paperboard Co.

SEE Newark Group Inc. listing in "Major firms (1,000 tpd)"

National Gypsum Co.

SEE "Major firms (1,000 tpd)"

Neenah Paper Co.

SEE Kimberly-Clark Corp. listing in "Major firms (1,000 tpd)"

Nekoosa Papers Inc.

SEE: Great Northern Nekoosa Corp. listing in "Major firms (1,000 tpd)"

New Brunswick International Paper

SEE CIP Inc. listing in "Major firms (1,000 tpd)"

Newark Group Inc.

SEE "Major firms (1,000 tpd)"

Newman & Co. Inc.

6101 Tacony St
Philadelphia, Pa. 19135
Milton Newman, president

Production facilities:

Paperboard—195 tpd chipboard, boxboard, manila, newsboard, specialty board

Newton Falls Paper Mill Inc.

SEE Stora Kopparberg North America listing in "Major firms (1,000 tpd)"

Niagara of Wisconsin Paper Corp.

SEE Pentair Inc. listing in "Major firms (1,000 tpd)"

Nicolet Inc.

Ford & Washington Sts
Norristown, Pa. 19401
Bernard Bergman, president/chief executive officer

Production facilities:

Paperboard—150 tpd asbestos paper, gasket, roofing

Nicolet Paper Co.

SEE Philip Morris Industrial Paper Group

Nitec Paper Corp.

SEE Repap Enterprises Inc. listing in "Major firms (1,000 tpd)"

Noranda Mines Ltd.

SEE "Major firms (1,000 tpd)"

Nordfibre Corp.

Box 910
North Bay, Ont. P1B 8K1
Frank Orsi, president/general manager

Production facilities:

Pulp—120 metric tpd groundwood
Building board—115 metric tpd asphalt, insulation board, sheathing, wallboard

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North End Paper Co.

(Sub. of Robertson Paper Co. Inc.)
702 Hannibal St.
Fulton, N.Y. 13069
Frederick E. Bidwell, vice president/general manager

Production facilities:

Paper—6 tpd pattern, waxing and wrapping tissue

North Pacific Paper Corp.

SEE Weyerhaeuser Co. listing in "Major firms (1,000 tpd)."

Northwood Pulp & Timber Co.

SEE Noranda Mines Ltd. & Mead Corp. listings in "Major firms (1,000 tpd)."

Noroton Pulp & Machinery Inc.

(former Skybel Tissue Mills Inc.)
1 John St. Ext.
Greenwich, N.Y. 12834
Frank E. Evers, president/chief executive officer

Production facilities:

Pulp—75 tpd secondary fiber & deinking
Paper—80 tpd tissue

Nova Scotia Forest Industries

SEE Stora Kopperberg North America listing in "Major firms (1,000 tpd)."

Nu-Valley Paper Co.

N. Bridge St.
Holyoke, Mass. 01040
Daniel Bergman, president

Production facilities:

Paper—50 tpd fine papers

Ohio Pulp Mills Inc.

(Affil. of Donco Paper Supply Co.)
2100 Losantiville Rd.
Cincinnati, Ohio 45237
Robert Mendelson, president

Production facilities:

Pulp—30 tpd repulped paper stock (for market)

Olin Corp.

(Ecusta Paper & Film Group)
Box 200
Pisgah Forest, N.C. 28768
Garza Baldwin Jr., Group president

Production facilities:

Pulp—250 tpd flax
Paper—cigaret, specialty and technical papers

Ontario Paper Co. Ltd.

SEE "Major firms (1,000 tpd)."

Owens-Illinois

SEE "Major firms (1,000 tpd)."

Packaging Corp. of America

SEE "Major firms (1,000 tpd)."

Pacific Coast Packaging Corp.

4444 Pacific Blvd.
Vernon, Calif. 90058
David Eklund, president

Production facilities:
(mill idle 1983)

Paperboard—130 tpd boxboard, chipboard, gypsum linerboard

Palmyra Paperboard Co.

(Big M Paperboard Inc.)
(formerly a Simplex Industries Inc. mill)
Palmyra, Mich. 49268
Ken Moran, president

Company filed for Chapter 11 bankruptcy hearing in September 1984

Production facilities:

Paperboard—60 tpd chipboard, tube stock, match stock

Paper Service Mills Inc.

Hinsdale, N.H. 03451
R.E. O'Neal, president/treasurer

Production facilities:

Paper—20 tpd napkin, toilet, packing tissue

Paper-Pak Products Inc.

1941 White Ave.
La Verne, Calif. 91750
M.G. Hopkins, chairman

Production facilities:

Paper—55 tpd cellulose wadding

Papier Cascades (Cabano) Inc.

SEE Cascades Inc. listing in "Major firms (1,000 tpd)."

Papier Kingsey Falls Inc.

SEE Cascades Inc. listing in "Major firms (1,000 tpd)."

Park Corp.

Box 77
Doswell, Va. 23047
Curtis Mullins, plant superintendent

Production facilities:
(Mill closed in 1981)

Pulp—170 tpd defibrated
Paper—hardboard

Parsons & Whittemore Inc.

SEE "Major firms (1,000 tpd)."

Parsons Paper

SEE NVF Co.

Pejepscot Paper

(Div. of Hearst Corp.)
Box 128
Brunswick, Maine 04011
R.A. Premo, president

Production facilities:

Pulp—150 tpd thermomechanical
Paper—165 tpd printing & publication; groundwood specialties

Penacook Fibre Co.

12 N. Main
Penacook, N.H. 03301
Roland E. Allen, president/general manager

Production facilities:

Paperboard—12 tpd counter board, shoeboard, wet machine board

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Pennsylvania General Paper Co.

(Beaver Dam Mill)
RD 3, Box 293
Coatesville, Pa. 19320
Ralph Bicking, mill manager

Production facilities:
(Mill closed 1983)

Paper—25 tpd creping, toweling

Penntech Papers Inc.

3 Barker Ave.
White Plains, N.Y. 10601
John Leslie, chairman/president

Production facilities:

JOHNSONBURG, PA.
Pulp—220 tpd bleached kraft
Paper—Total 380 tpd: 285 tpd fine papers, 95 tpd printing/publication

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Pentair Inc.

SEE: "Major firms (1,000 tpd)."

Perkins Paper Ltd.

5230 S. Service Road
Burlington, Ont. L7L 5K2
E. A. Boyle, president/chief executive officer

Production facilities:

CANDIAC, QUE.
(former Bowater Inc. mill)
Pulp—1,000 tpd deinking
Paper—100 tpd tissue

Perkit Folding Box Corp.

36 Poydras St.
Mattapan, Mass. 02126
Sheldon Appel, president

Production facilities:

Paper—65 tpd boxboard

Philip Morris Industrial Paper Group

(Sub. of Philip Morris Inc.)
100 Park Ave.
New York, N.Y. 10017
Richard W. Detrick, president, Paper Group

Production facilities:

PLAINWELL, MICH.
(Plainwell Paper Co.)
Paper—Total 245 tpd: printing/writing 137 tpd; special industrial 108 tpd

DE PERE, WIS.
(Nicolet Paper Co.)
Paper—140 tpd glassine, greaseproof, release, sanitary, waxing

MENASHA, WIS.
(Wisconsin Tissue Mills)
Pulp—deinking
Paper—300 tpd napkin tissue

Total production capacity:

Pulp	n.a.
Paper	685 tpd

Plainwell Paper Co.

SEE: Philip Morris Industrial Paper Group

Ponderosa Fibres of America

2814 New Spring Rd., Suite 205
Atlanta, Ga. 30339
Ed Sokolowsky, vice president, administration

Production facilities:

SANTA ANA, CALIF.
(B.J. Fibres)
Pulp—100 tpd deinking (for market)

AUGUSTA, GA.
(Ponderosa Georgia Corp.)
Pulp—100 tpd deinking (for market)

OGDENSBURG, N.Y.
(Formerly St. Lawrence Pulp & Paper Co.)
Pulp—120 tpd deinking (for market)

MEMPHIS, TENN.
(Ponderosa of Tennessee)
Pulp—100 tpd deinking (for market)

OSHKOSH, WIS.
(Ponderosa Pulp Products Corp.)
Pulp—100 deinking (for market)

Total production capacity:

Pulp	520 tpd

Ponderosa Paper Products Concel Inc.

SEE: APL Corp.

Pope & Talbot Inc.

SEE: "Major firms (1,000 tpd)."

Portals Inc.

Sub. of Portals Ltd. (U.K.)
Hawkinsville, Ga.

Bank note; document

Port Huron Paper Co.

SEE: Pentair Inc. listing in "Major firms (1,000 tpd)."

Port Townsend Paper Corp.

(Div. of Haindl Paper Co.)
Box 3170
Port Townsend, Wash. 98368
Juan del Valle, president

Production facilities:

Pulp—450 tpd unbleached kraft softwood (pulp available for market)
Paper—450 tpd linerboard, kraft packaging

Potlatch Corp.

SEE: "Major firms (1,000 tpd)."

Potsdam Paper Corp.

SEE: Little Rapids Corp.

Prairie State Paper Mills

(Div. of Chippewa Paper Products Co., sub. of Ivex Corp.)
292 Logan
Joliet, Ill. 60433
L.G. Holzbach, president

Production facilities:

Paper & board—150 tpd chipboard, can stock & liner, kraft board, mill wrappers, roofing, saturating

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Preco Corp.

Front St.
West Springfield, Mass. 01089
J. H. Torras, president/chief executive officer

Production facilities:

LINCOLN, MAINE
(Lincoln Pulp & Paper Co. Inc.)
Pulp—350 tpd bleached kraft
Paper—Total 350 tpd: 165 tpd fine papers, 95 tpd tissue

WEST SPRINGFIELD, MASS.
(Premoid Corp.)
Paper—30 tpd nonwovens

BROWNVILLE, N.Y.
(Premoid Corp., Brownville Div.)
Paper—50 tpd special industrial, technical papers

Total production capacity:

Pulp	350 tpd
Paper	430 tpd

Premoid Corp.
SEE: Preco Corp.

Price Co.
SEE: Abitibi-Price Inc. listing in "Major firms (1,000 tpd)"

Price Wilson Inc.
(Sub. of Inter-City Papers Ltd.)
150 Clement St.
La Salle, Que. H8R 4A3
J. C. Chipman, president

Production facilities:

Paper—21 metric tpd industrial towels, absorbent, bag, creping

Prince Albert Pulp Co. Ltd.
SEE: "Major firms (1,000 tpd)"

Prince George Pulp & Paper Ltd.
SEE: Canfor Inc. listing in "Major firms (1,000 tpd)"

Procter & Gamble Co.
SEE: "Major firms (1,000 tpd)"

Provincial Papers
SEE: Abitibi-Price listing in "Major firms (1,000 tpd)"

Publishers Paper Co.
SEE: "Major firms (1,000 tpd)"

Putney Paper Co. Inc.
SEE: Ashuelot Paper Co.

Q.N.S. Paper Co. Ltd.
SEE: Ontario Paper Co. Ltd. listing in "Major firms (1,000 tpd)"

Quaker Oats Co., Paper Div.
Box 520
Pekin, Ill. 61555
Dale Rowsey, plant manager

Production facilities:

Paperboard—85 tpd boxboard, chipboard

Quesnel River Pulp Co.
Box 9500
Quesnel, B.C. V2J 5C3
R. F. Forbes, president

(Joint venture of West Fraser Mills Ltd. & Daishowa Canada Co. Ltd.)

Production facilities:

Pulp—490 metric tpd thermomechanical (for market)

Quin-T Corp. New Hampshire
(Div. of CLS Industries Inc.)
Box 309
Tilton, N.H. 03276
F. L. Wardley, president

Production facilities:

Paperboard—asbestos, insulating, transformer board

Quin-T Corp.-Pennsylvania
(Technical Papers & Boards Div.)
Box 1151
Erie, Pa. 16509
A. W. De Groot, vice president-production

Production facilities:

Paper/board: 100 tpd total: 85 tpd special industrial papers, 15 tpd paperboard

RPM Board & Carton Corp.
(formerly Rockford Paper Mills Inc.)
7000 N. Mannheim Rd.
Rosemont, Ill 60018
Seymour Rose, chairman

Production facilities:

ROCKFORD, MICH.
Paperboard—100 tpd boxboard, chipboard, folding boxboard

Rayonier Quebec Ltd.
SEE: ITT Rayonier Inc. listing in "Major firms (1,000 tpd)"

Reading-White Hall Paper Board Co.
SEE: Maryland Paper Box Co.

Red Hook Paper Corp.
(formerly Atlantic Asbestos Corp.)
Spring Lake Rd., Box 133
Red Hook, N.Y. 12571
Barry Hull, president

Production facilities:

Chipboard—15 tpd

Reed Inc.
SEE: "Major firms (1,000 tpd)"

Reid Dominion Packaging Ltd.
81 Elgin St.
Brantford, Ont. N3T 5T6
W.R. Burroughs, vice president/general manager

Production facilities:

Molded pulp products—egg cartons

Repap Enterprises Inc.
SEE: "Major firms (1,000 tpd)"

Republic Gypsum Co.
3625 Miller Park Dr.
Garland, Texas 75040
O. Max Montgomery, president

Production facilities:

COMMERCE CITY, COLO.
Combination (recycled) board—145 tpd

HUTCHISON, KAN.
Combination (recycled) board—250 tpd

SLIDELL, LA.
(Mill permanently closed)

Paperboard—28 tpd roofing felt

Total production capacity:

Paperboard	395 tpd

Rhinelander Paper Co.
SEE: Wausau Paper Mills Co.

Riegel Custom Products Corp.
SEE: James River Corp. listing in "Major firms (1,000 tpd)"

Rising Paper Co.
Park St.
Housatonic, Mass. 01236
Robert E. O'Connor, president

Production facilities:

Pulp—50 tpd rag, sulfite
Paper—60 tpd fine papers, art, bond, bristols, papeterie, technical, specialties

Riverside Paper Corp.
SEE Amricon Corp.

Robel Tissue Mills Inc.
SEE APL Corp.

G.E. Robertson & Co.
Canal St.
Hinsdale, N.H. 03451
Leo J. Gratton, president

Production facilities:

Paper—8 tpd toilet and specialty tissue

Robertson Paper Box Co. Inc.
(Sub. of Robertson Group Inc.)
Oakdale Rd.
Montville, Conn. 06353
Ralph A. Powers Jr., president

Production facilities:

Paperboard—65 tpd boxboard, chipboard, specialty board

Rock-Tenn Co.
504 Thrasher St., Box 4098
Norcross, Ga. 30091
A.W. Brown, chairman/chief executive officer

Rock-Tenn bought the Dallas, Tex., and Eaton, Ind., mills from Clevepak Corp. in 1979 and 1983, respectively. The Delaware Water Gap, Pa., mill was purchased in September 1984 from Toronto Paperboard Co., which had bought the mill from Packaging Corp. of America in July 1983 and had named it Stroudsburg Paperboard Co.

Production facilities:

EATON, IND.
Paperboard—140 tpd chipboard

DELAWARE WATER GAP, PA.
Paper/board—120 tpd specialty, antitarnish, kraft

CHATTANOOGA, TENN.
Paperboard—300 tpd recycled paperboard

DALLAS, TEXAS
Paperboard—400 tpd recycled paperboard

Total production capacity:

Paperboard 960 tpd

Rockford Paper Mills Inc.
SEE RPM Board & Carton Corp.

Rogers Corp.
Rogers, Conn. 06263
N. L. Greenman, president/chief executive officer

Production facilities:

MANCHESTER, CONN.
Paperboard—10 tpd molding board

ROGERS, CONN.
(Rogers Mill)
Paperboard/building board—35 tpd fiberboard, gasket, insulation board, specialty

Total production capacity:

Paperboard/bldg. board 45 tpd

Rolland Inc.
800 Victoria Square, Suite 3620
Montreal, Que. H4Z 1H3
Lucien G. Rolland, chairman/chief executive officer

Production facilities:

MONT ROLLAND, QUE.
Paper—60 metric tpd fine papers, printing/writing, rag, technical, kraft, electrical insulating, specialties

ST. JEROME, QUE.
Paper—345 metric tpd fine papers, thin papers, printing/writing & publication, business form, rag, specialties

Total production capacity:

Paper 405 metric tpd

Rothesay Paper Ltd.
SEE Irving Pulp & Paper Ltd. listing in "Major firms (1,000 tpd)"

St. Anne-Nackawic Pulp & Paper Co. Ltd.
SEE Parsons & Whittemore Inc. listing in "Major firms (1,000 tpd)"

St. Joe Paper Co.
SEE "Major firms (1,000 tpd)"

St. Lawrence Pulp & Paper Co.
SEE Ponderosa Fibres of America

St. Marys Paper Co.
Huron St.
Sault Ste. Marie, Ont. P6A 5P4
Don Alexander, president/chief executive officer

Production facilities:

Pulp—350 metric tpd stone groundwood
Paper—325 metric tpd groundwood, coated & specialties

St. Raymond Paper Co. 1983 Inc.
1155 Dorchester Blvd. W., Rm. 2916
Montreal, Que. H3B 2H9
W.F. Clifford, president

Production facilities:

DESBIENS, QUE.
Pulp—120 metric tpd unbleached sulfite and screenings (for market)

ST. RAYMOND (Chute Panet), QUE.
Pulp—60 metric tpd groundwood
Paper—220 metric tpd groundwood specialties

St. Regis Paper Corp.
SEE "Major firms (1,000 tpd)"

Schoeller Technical Papers Inc.
SEE Mead Corp. listing in "Major firms (1,000 tpd)"

Scott Maritimes Ltd.
SEE Scott Paper Co. listing in "Major firms (1,000 tpd)"

Scott Paper Co.
SEE "Major firms (1,000 tpd)"

Seaman Paper Co. of Massachusetts Inc.
Main St.
Otter River, Mass. 01436
George Jones III, president

Production facilities:

Paper—85 tpd carbonizing, printing, specialties

Shawano Paper Mills
SEE: Little Rapids Corp.

Shoreham Packaging Group Inc.
(Watervliet Paper Co. Inc.)
279 Paw Paw Ave.
Watervliet, Mich. 49098
David D. Stiles, president

Production facilities:

Paper—120 tpd printing & specialty papers, coated, label, playing card

Shryock Bros. Inc.
Box 157
Downingtown, Pa. 19335
Robert M. McIlvain, president

Production facilities:

Paper & board—26 tpd binders board, specialty paper

Sierra Tissue Co. Inc.
560 E. Commercial St.
Pomona, Calif. 91766
Walter A. Richter, president

Production facilities:

Paper—12 tpd cellulose wadding

Simkins Industries Inc.
259 East St.
New Haven, Conn. 06508
Leon J. Simkins, president

Production facilities:

NEW HAVEN, CONN.
(New Haven Board Div.)
Paperboard—220 tpd boxboard, lined board, manila, news, patent-coated

INDIANAPOLIS, IND.
(Beveridge Paper Co. Inc.)
Paperboard—60 tpd bristols, mill boards, specialty

CATONSVILLE, MD.
(Maryland Board Div.)
Paperboard—170 tpd boxboard, chipboard, cracker shell, newsboard

LEE, MASS.
(Westfield River Paper Co. Inc.)
Paper—90 tpd glassine

RUSSELL, MASS.
(Westfield River Paper Co. Inc.)
Paper—50 tpd glassine

RIDGEFIELD, N.J.
(Lowe Paper Co.)
Paperboard—140 tpd boxboard, laminating, postcard, specialty

Total production capacity:

Paper	140 tpd
Paperboard	590 tpd
Total	730 tpd

Simplex Industries Inc.
(Div. of Anthony Industries Inc.)
3000 W. Beecher St.
Adrian, Mich. 49221
Robert E. Doyle, president

Production facilities:

CONSTANTINE, MICH.
Paperboard—100 tpd chipboard

Simplicity Pattern Co. Inc.
200 Madison Ave.
New York, N.Y. 10016
Lilyan Affinito, president

Production facilities:

NILES, MICH.
Paper—35 tpd pattern tissue

Simpson Paper Co.
SEE: "Major firms (1,000 tpd)"

Skybel Tissue Mills Inc.
SEE: Noroton Pulp & Machinery Inc.

Jefferson Smurfit Corp.
SEE: "Major firms (1,000 tpd)"

Sonoco Products Co.
SEE: "Major firms (1,000 tpd)"

Sorg Paper Co.
SEE: Mosinee Paper Corp.

F.F. Soucy Inc. and F.F. Soucy Inc. et Associés
SEE: Bato Co. Inc. listing in "Major firms (1,000 tpd)"

South Carolina Industries Inc.
SEE: Stone Container Corp. listing in "Major firms (1,000 tpd)"

Southeast Paper Mfg. Co.
SEE: Garden State Paper listing in "Major firms (1,000 tpd)"

Southern Cellulose Products Inc.
SEE: Filtration Science Corp.

Southwest Forest Industries Inc.
SEE: "Major firms (1,000 tpd)"

Southworth Co.
Front St.
West Springfield, Mass. 01089
John H. Southworth, president

Production facilities:

Paper—17 tpd fine papers

Spaulding Fibre Co. Inc.
(Sub. of Nortek)
310 Wheeler St.
Tonawanda, N.Y.
R. Hunter, president

Production facilities:

NORTH ROCHESTER, N.H.
Paper & board—15 tpd special industrial paper, 25 tpd paperboard

TONAWANDA, N.Y.
Paper—25 tpd special industrial absorbent, for vulcanized fiber

Total production capacity:

Paper & board	65 tpd

Specialty Paper Mills Inc.
8834 South Millergrove Dr.
Santa Fe Springs, Calif. 90670
J.A. Gabriel, president

Production facilities:

Paperboard—corrugating medium

Spruce Falls Power & Paper Co. Ltd.
SEE: Kimberly-Clark Corp. listing in "Major firms (1,000 tpd)"

Statler Tissue Corp.
(Sub. of Statler Industries Inc.)
300 Middlesex Ave.
Medford, Mass. 02155
Leonard Sugarman, president

Production facilities:

AUGUSTA, MAINE
Paper—150 tpd facial, napkin, toilet and toweling

CLAYVILLE, N.Y.
(Doeskin Inc.)
(Mill idle)
Paper—75 tpd tissue, wadding

Total production capacity:

Paper	150 tpd

Stevens Paper Mills Inc.
77 Mill St.
Westfield, Mass. 01085
David R. Schoales, president

Production facilities:
(Mill closed 1981)
Paper—8 tpd specialty tissue

Stevens & Thompson Paper Co.
(Sub. of Dixico Inc.)
Box 206
Greenwich, N.Y. 12834
Emory L. Waldrip II, president

Production facilities:

Paper—60 tpd facial, toilet and toweling tissue

Stone Container Corp.
SEE: "Major firms (1,000 tpd)"

Stora Kopperberg North America
SEE: "Major firms (1,000 tpd)"

Strathcona Paper Co.
(Div. of Roman Corp. Ltd.)
Strathcona, Ont. K7R 3L6
W.E. Riddolls, president

Production facilities:

Paperboard—156 metric tpd boxboard, chipboard, newsboard

Strathmore Paper Co.
SEE: Hammermill Paper Co. listing in "Major firms (1,000 tpd)"

Stroudsburg Paperboard Co.
SEE: Rock-Tenn Co.

Superior Fiber Products Inc.
(Sub. of Carlson Companies Inc.)
N. 5th St. & Bayfront, Box 365
Superior, Wis. 54880
Robert Fryberger, president

Production facilities:

Pulp—275 tpd defibrated
Building board—hardboard

Sweetwater Paper Board Co.
SEE: Caraustar Industries Inc. listing in "Major firms (1,000 tpd)"

TLR Corp.
Box 719, 1 Mill St.
Bellows Falls, Vt. 05101
Thomas L. Riley, president/chief executive officer

Production facilities:

Paper—25 tpd braille, construction, mill wrappers

Tagsons Papers Inc.
Mechanicville, N.Y. 12118
Eugene J. Galante, president/treasurer

Production facilities:

Paper—150 tpd toweling, creping paper & tissue

Tahsis Co. Ltd.
SEE: CIP Inc. listing in "Major firms (1,000 tpd)"

Tallman Conduit Co.
600 S. Main St.
Louisiana, Mo. 63353
Roscoe B. Tallman, president/treasurer

Production facilities:

Building board—pipe conduit

Tamko Asphalt Products Inc.
4th & Wall, Box 1404
601 N. High St.
Joplin, Mo. 64801
Ethelmae Humphreys, chairman

Production facilities:

TUSCALOOSA, ALA.
Roofing

PHILLIPSBURG, KAN.
Building board—80 tpd roofing felt

JOPLIN, MO.
Building board—140 tpd roofing felt

KNOXVILLE, TENN.
Pulp—80 tpd defibrated
Building board—200 tpd roofing felt

Total production capacity:

Pulp	80 tpd
Building board	420 tpd

Tarkett Inc.
(Sub. of Swedish Match AB)
1139 Lehigh Ave.
Whitehall, Pa. 18052
V. L. Ujcic, plant manager

Production facilities:

Flooring felt

Technographics Inc.
(Mills purchased from Litton Industries Inc.)
601 River St.
Fitchburg, Mass. 01420
John Grudo, president

Production facilities:

LOCKPORT, LA.
(Valentine Pulp & Paper Co.)
Paper—125 tpd fine paper, printing/writing

FITCHBURG, MASS.
(Fitchburg Paper Co.)
Paper—225 tpd book, fine paper, kraft paper, papeterie, reprographic, specialty, technical

Total production capacity:

Paper	350 tpd

Tecumseh Corrugated Box Co.
Box 427
Tecumseh, Mich. 49286
James Robideau, president

Production facilities:

BRECKSVILLE, OHIO
(Jaite Mill Div.)
Paperboard—70 tpd chipboard, bogus

Tembec Inc.
800 Dorchester Blvd. W., Suite 2790
Montreal, Que. H3B 1X9, Canada
F.A. Dottori, president/chief executive officer

Production facilities:

TEMISCAMING, QUE.
Pulp—550 metric tpd sulfite specialty and dissolving (for market)

Temple-Eastex Inc.
SEE: Temple-Inland Inc. listing in "Major firms (1,000 tpd)."

Temple-Inland Inc.
SEE: "Major firms (1,000 tpd)."

Tennessee River Pulp & Paper Co.
SEE: Packaging Corp. of America listing in "Major firms (1,000 tpd)."

Texon Inc.
(Div. of Emhart Corp.)
Canal St.
South Hadley, Mass. 01075
A. Peter Clackson, president, Emhart Footwear Mat. Group

Production facilities:

RUSSELL, MASS.
Paper & board—150 tpd art paper, coating base, counterboard, specialty paper & board

SOUTH HADLEY, MASS.
Paper & board—coating base, art, impregnating, saturating, specialty board

Thilmany Pulp & Paper Co.
SEE: Hammermill Paper Co. listing in "Major firms (1,000 tpd)."

3M Co.
3M Center
St. Paul, Minn. 55144
D.C. Vadnais, vice president

Production facilities:

HARTFORD CITY, IND.
(Visual Div.)
Paper—50 tpd business forms paper

Tomahawk Power & Pulp Co.
N10099 Kings Road
Tomahawk, Wis. 54487
Gerald Cook, plant manager

Production facilities:

Pulp—30 tpd groundwood (for market)

Toronto Paperboard Co.
Loretta Ave.
Toronto, Ohio 43964
C. A. Dufon, president/chief operating officer

Production facilities:

Paperboard—150 tpd boxboard, chipboard, containerboard, core stock, specialties

Trent Valley Paperboard Mills
Trenton, Ont. K8V 5R8
R.M. Bryden, president/chief executive officer

Production facilities:

East Mill—100 metric tpd boxboards, specialty boards
West Mill—180 metric tpd linerboard and boxboards

Total production capacity:

Paperboard 280 metric tpd

Union Camp Corp.
SEE: "Major firms (1,000 tpd)."

U.S. Paper Mills Corp.
825 Ft. Howard Ave., Box 3309
De Pere, Wis. 54115
Walter R. Cloud, president/treasurer

Production facilities:

DE PERE, WIS.
Recycled board—100 tpd can and core stock, boxboard, chipboard, building paper and board

MENASHA, WIS.
(former Menasha Corp. mill)
Combination (recycled) board—175 tpd

Total production capacity:

Recycled paperboard 275 tpd

United States Gypsum Corp.
SEE: "Major firms (1,000 tpd)."

United States Paper Mills Inc.
Chambersburg, Pa. 17201
Dunbar A. Rosenthal, president/treasurer

Production facilities:

Paper—35 tpd creping, industrial, toweling

Upson Co. Inc.
SEE: Domtar Inc. listing in "Major firms (1,000 tpd)."

Valentine Pulp & Paper Co.
SEE: Technographics Inc.

Vermont Tissue Paper Corp.
Rte. 67-A
North Bennington, Vt. 05257
Edward Woodward, president

Production facilities:
Paper—10 tpd tissue

Vincennes Paper Mill Inc.
SEE: American Paper Products Co.

Virginia Fibre Corp.
SEE: "Major firms (1,000 tpd)."

Ward Paper Co.
(Div. of Arvey Corp.)
N. Mill St.
Merrill, Wis. 54452
Bruce Skofronick, vice president/general manager

Production facilities:

Pulp—60 tpd deinking
Paper—90 tpd bond, duplicator, mimeograph, fine papers

Warrensburg Board & Paper Corp.
Warrensburg, N.Y. 12885
Arthur Radin, president

Production facilities:

Paperboard—140 tpd corrugating medium, jute, linerboard, kraft board, wrapping tissue

Watervliet Paper Co. Inc.

SEE Shoreham Packaging Group Inc.

Wausau Paper Mills Co.

One Clark's Island, Box 1408
Wausau, Wis. 55401
Richard L. Radt, president/chief executive officer

Production facilities:

BROKAW, WIS.
(Brokaw Div.)
Pulp—170 tpd sulfite
Fine and specialty paper—420 tpd

RHINELANDER, WIS.
(Rhinelander Paper Co.)
(Pulp mill closed)

Glassine and greaseproof specialties—300 tpd

Total production capacity:

Pulp	170 tpd
Paper	720 tpd

Welclad Industries Canada Ltd.

515 Munroe Ave.
Winnipeg, Man. R2K 1H7
E. L. Cherwick, president

Production facilities:

Pulp—groundwood
Paper/board—wallboard, fiberboard

Westar Timber Ltd.

SEE "Major firms (1,000 tpd)"

Western Electric Co.

(Sub. of AT & T Co.)
222 Broadway
New York, N.Y. 10038

Production facilities:

CHICAGO, ILL.
(Hawthorne Works)
Paperboard—35 tpd electrical insulating

Western Forest Products Ltd., Western Pulp Inc.

SEE Western Pulp Limited Partnership listing in "Major firms (1,000 tpd)"

Western Pulp Limited Partnership

SEE "Major firms (1,000 tpd)"

Westfield River Paper Co. Inc.

SEE Simkins Industries Inc.

Weston Paper & Mfg. Co.

2001 N. 19th St., Box 238
Terre Haute, Ind. 47808
M. T. Hubbard, chairman

Production facilities:

Pulp—300 tpd semichemical
Paperboard—425 tpd corrugating medium

Westvaco Corp.

SEE "Major firms (1,000 tpd)"

Weyerhaeuser Co.

SEE "Major firms (1,000 tpd)"

Whippany Paper Board Co. Inc.

101 N. Jefferson Rd.
Whippany, N.J. 07981
Frank Desiderio, president

Declared bankruptcy in 1980. Durham mill in Durham, Pa., sold to Durham Mills Inc. in 1981. Eden mill at Whippany, N.J., was under option to Container Corp. of America, but the option was dropped early in 1984 when necessary permits could not be obtained. The Clifton, N.J., mill was sold to Clifton Paperboard Co. Inc.

Production facilities:

WHIPPANY, N.J. (Eden Mill)
(Mill closed 1980)
Recycled paperboard—1,000 tpd

White Pigeon Paper Co.

Box 277
White Pigeon, Mich. 49099
James V. Lamarre, president

Production facilities:

Paperboard—170 tpd boxboard

George A. Whiting Paper Co.

100 River St.
Menasha, Wis. 54952
Frank B. Whiting, chairman/chief executive officer

Production facilities:

Paper—22 tpd art paper, fine papers, papeterie, specialties

Willamette Industries Inc.

SEE "Major firms (1,000 tpd)"

Windsor Stevens Inc.

Stevens Mill Rd.
Windsor, Conn. 06095
Milton Gordon, president

Production facilities:

Paperboard—10 tpd insulating, fiberboard, pressboard, trunk board

Wisconsin Paperboard Corp.

SEE Newark Group Inc. listing in "Major firms (1,000 tpd)"

Wisconsin Tissue Mills

SEE Philip Morris Industrial Paper Group

Woodstream Corp.

Front & Locust Sts.
Lititz, Pa. 17543
R.G. Woolworth, chairman/chief executive officer

Production facilities:

Molded pulp products—9 tpd

Yorktowne Paper Mills Inc.

Loucks Mill Rd.
York, Pa. 17405
Daniel J. Sparler, board chairman/president

Production facilities:

GARDINER, MAINE
(Yorktowne Paper Mills of Maine Inc.)
Paper & board—80 tpd chipboard, car & case lining, core stock & cores, specialties

YORK, PA.
Paper—100 tpd boxboard, chipboard, can & core stock & cores, fiberboard

Total production capacity:

Paperboard	180 tpd